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CLARK COUNTY, WA





Clark County Pedestrian Crossing Treatment Policy

PREPARED JOINTLY WITH HDR

INTEROFFICE MEMORANDUM

Transportation Division

Clark County, Washington
Department of Public Works

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DATE: November 19, 2018
SUBJECT Pedestrian Crossing Treatment Policy

Clark County is committed to enhancing mobility and safety for all modes of transportation including bicycles and pedestrians. In line with the mission statement of the Clark County Traffic Engineering Section, the county has prepared this *Pedestrian Crossing Treatment Policy*. The purpose of this policy is to recommend appropriate pedestrian crossing treatments to enhance pedestrian safety and to ensure continued pedestrian mobility.

In accordance with the *Washington State Department of Transportation's Design Manual*, the indiscriminate marking of pedestrian crossings is discouraged because the overuse of marked crosswalks leads to unsafe pedestrian crossing conditions and non-compliance of traffic control by drivers. The policy utilizes objective criteria to recommend pedestrian crossing treatments under varying sets of roadway geometrics, traffic operations and pedestrian crossing demand.

With a focus on uniformity of application, this policy follows a three-step process to guide the consideration and selection of pedestrian crossing treatments.



The methodology was primarily based upon pedestrian delay from the *Highway Capacity Manual*. The delay analysis evaluated a set of typical pedestrian crossings to determine appropriate crossing treatments based on established delay thresholds. The hierarchy of treatment options recommended in this policy is based on the latest research regarding drivers yielding to pedestrians.

The guidance provided in this document must be followed up with an engineering evaluation including a field assessment prior to finalizing a decision regarding a pedestrian crossing treatment. Pedestrian treatment options listed in this document may be modified to include a combination of treatment options or alternate treatment options may be provided for unique cases.

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
MUTCD	Manual on Uniform Traffic Control Devices
MPH	Miles per Hour
NCHRP	National Cooperative Highway Research Program
PHB	Pedestrian Hybrid Beacon
RCW	Revised Code of Washington
SSD	Stopping Sight Distance
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation



CHAPTER I: INTRODUCTION

1.1 Pedestrian Crossing Treatment Policy Background

Clark County, Washington has been experiencing an increased demand to provide enhanced pedestrian facilities. As demand for pedestrian mode of travel continues to increase, the County is committed to provide infrastructure for a seamless network and efficient movement of pedestrians, including a variety of pedestrian crossing treatments. The Clark County Pedestrian Crossing Treatment Policy has developed decision-making guidelines to help recommend the appropriate pedestrian crossing treatment, best suited for each potential location. This policy is intended to inform and guide developers and County staff about triggers, considerations, and requirements associated with the implementation of enhanced crossing treatments within Clark County.

The purpose of this policy is to define trigger points for pedestrian crossing treatments and recommend appropriate pedestrian crossing treatments to enhance pedestrian safety and to ensure continued pedestrian mobility.

The guidelines provided in this policy cover the suitability of marked crosswalks, flashing beacons and pedestrian hybrid beacons, and standards for traffic control devices including signing, striping, pavement markings, and illumination to ensure consistent and uniform applications. The crossing treatment applications contained in this document are not the only treatments that may be used. Variations of the above mentioned treatments or other pedestrian crossing treatments as prescribed in the Federal Highway Administration's Pedestrian Crossing Treatment Toolbox¹ may be used to address unique situations.

1.2 Pedestrian Crossing Treatment Decision Process

This policy introduces the Pedestrian Crossing Treatment Decision Process, which includes three steps that guide the consideration and selection of pedestrian crossing treatments. The three-step process, outlined below in Figure 1, includes Pedestrian Crossing Treatment Decision Trees for controlled crossings at intersections, uncontrolled crossings at intersections or mid-block locations and school crossing locations; an Enhanced Crossing Treatment Selection Table; and conceptual Pedestrian Crossing Toolbox Cut Sheets to guide facility implementation.

¹ <https://www.fhwa.dot.gov/publications/research/safety/01102/01102.pdf>



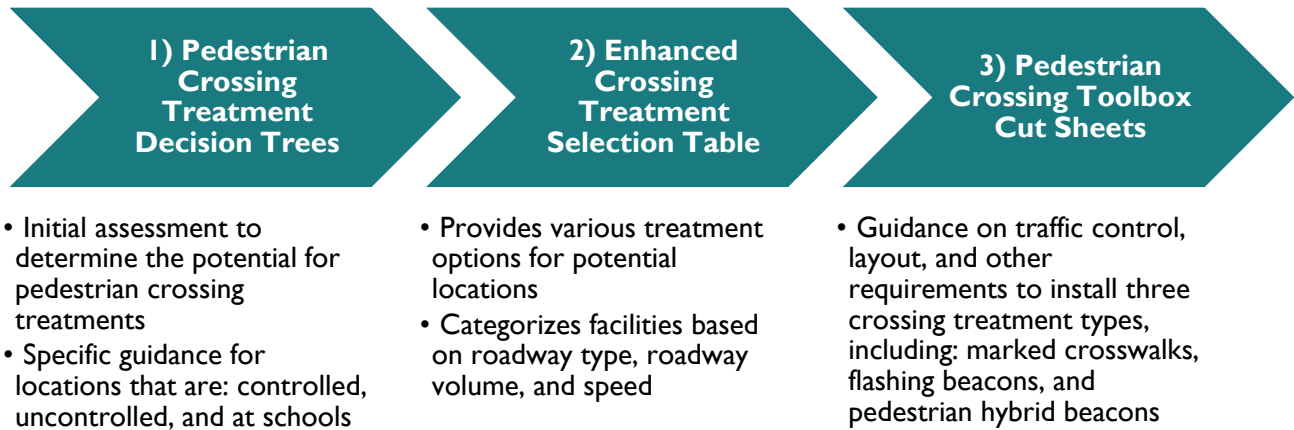


Figure 1. Pedestrian Crossing Treatment Decision Process

The following describes the pedestrian crossing treatment decision process in further detail:

1. Pedestrian Crossing Treatment Decision Trees

The decision trees are an initial assessment to assist in determining the suitability of pedestrian crossing treatments at an existing or proposed pedestrian crossing location based on a series of criteria. This includes specific guidance on locations that are uncontrolled, controlled (for both signals and stop signs), or near schools, and includes criteria that considers shared-use path locations, roadway volumes, pedestrian volumes, and proximity to existing crosswalks. To prevent proliferation of unwarranted marked crosswalks, the use of traffic engineering guidelines such as the Washington State Department of Transportation’s *Design Manual* discourages the indiscriminate use of marked crosswalks. An engineering evaluation including a field assessment should always be conducted prior to finalizing a decision regarding a pedestrian crossing treatment. In addition, a pedestrian crossing treatment may be provided to channelize pedestrians at a certain location.

2. Enhanced Crossing Treatment Selection Table

The selection table provides appropriate treatment options for potential locations under various sets of pedestrian, vehicle, and roadway conditions. The table categorizes facilities based on roadway type, roadway volume, and speed at specific crossing locations under consideration.

3. Pedestrian Crossing Toolbox Cut Sheets

The cut sheets provide implementation guidance on traffic control, general layout, and other requirements to install three crossing treatment types, including marked crosswalks, flashing beacons, and pedestrian hybrid beacons (PHB).



CHAPTER 2: CROSSWALK BASICS

2.1 Definitions

An **unmarked crosswalk** is a legal crossing, at a public road intersection, without any pavement marking feature delineating the crossing. Unmarked crosswalks include the portion of the roadway behind a prolongation of the curb or edge of the through traffic lane and a prolongation of the farthest sidewalk connection.²

A **marked crosswalk** is a legal crossing with the traffic control feature of pavement markings delineating the crossing. Marked crosswalks can be used at intersections or mid-block locations. Crosswalks are not to be marked indiscriminately. When crosswalks are marked, they shall follow Clark County Standard Detail T3.0.

Controlled crossings are legal crosswalks across a roadway approach that is controlled by a positive regulatory traffic control device such as a stop sign, traffic signal or pedestrian hybrid beacon.

Uncontrolled crossings are legal crosswalks across a roadway approach not controlled by a positive regulatory traffic control device. Uncontrolled crossings can occur at intersections or mid-block locations. Uncontrolled crossings may need to be enhanced with additional warning devices in various forms such as static signs or flashing beacons.

Public road intersections are legal crossings for pedestrians even without the pavement marking. Because drivers do not expect pedestrians to cross at mid-block locations, it is preferable to install pedestrian crossing treatments at public road intersections. There are situations where a mid-block pedestrian crossing can be considered, however engineering judgment should be used and the decision to recommend a mid-block pedestrian crossing should be documented. Factors to include regarding the use of mid-block pedestrian crossings include the following:

- On roadways with very high pedestrian crossing traffic caused by nearby pedestrian generators.
- Modal interchange points where high volumes of crossing pedestrians occur (e.g., transit stop to an apartment complex).
- High pedestrian crossing volumes present with long block spacing and the out-of-direction travel to the nearest controlled crossing exceeds 600 feet.
- Crash history at mid-block locations.
- Realistic opportunity to channel multiple pedestrian crossings to a single location.
- Sight lines that enable sufficient eye contact between motorists and pedestrians.
- Community commitment for a successful outcome.
- Ability to mitigate risks associated with the location using proven countermeasures such as, but not limited to, refuge islands, flashing beacons, and/or pedestrian hybrid beacons.³

Care should be taken to ensure that all signing, striping, and pavement markings intended to warn the drivers of the approaching mid-block pedestrian crossing locations are conspicuous to the maximum extent possible.

School crossings are uncontrolled crossings, and Clark County requires the protection of an adult crossing guard. See the Clark County School Zone Traffic Control Policy for further detail.

² WSDOT Design Manual Section 1510.10(2)(a)

³ WSDOT Design Manual Section 1510.10



2.2 Laws and Rules about Pedestrian Crossings

Laws and rules about pedestrian crossings are set at both the national, state, and county levels. Several national, state, and county manuals provide guidance on the implementation of pedestrian crossing traffic control devices that are compliant with the laws. National guidance should be used unless there is a Washington State or Clark County modification in place. Figure 2 shows the sources for laws and rules that were used to develop this policy regarding pedestrian crossings grouped at the national, state and county levels.

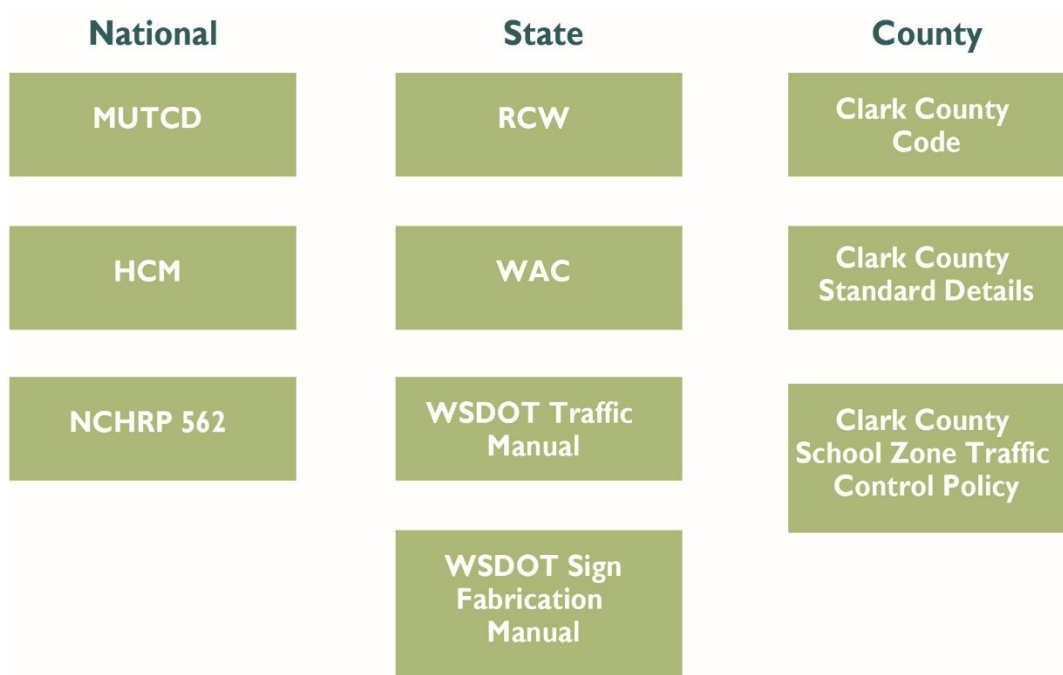


Figure 2. Sources for Pedestrian Crossing Laws and Rules

Manual on Uniform Traffic Control Devices (MUTCD)

The MUTCD, published by the Federal Highway Administration (FHWA), sets national standards and guidelines for traffic control devices along facilities open to public travel (see Appendix A for more details).

Traffic control devices for pedestrian crossings are covered in various parts of the manual (Parts 2, 3, and 4).

The MUTCD provides guidance on the following items related to pedestrian crossings:

- Pedestrian crossing signs and pavement markings
- Warrants for traffic signals based on pedestrian volume
- Warrants for pedestrian hybrid beacons
- Provisions for pedestrians at signalized locations

Uniform application of traffic control devices is a proven method of improving safety at pedestrian crossings. Uniformity avoids confusion among road users and promotes consistent behavior and expectations.



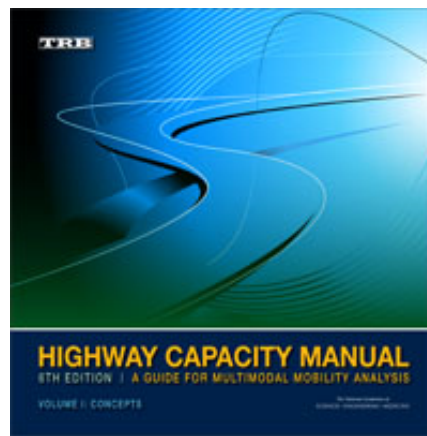
The MUTCD emphasizes the importance of uniformity by providing standards and guidance on many aspects of signing and pavement markings, such as sign sizes, color, location, mounting height, and retro-reflectivity.

Highway Capacity Manual (HCM)

The HCM provides methods to quantify highway capacity and quality of service. The HCM is published by the Transportation Research Board and is the national standard.

It consists of four dimensions:

- Quantity of travel, the magnitude of use of a transportation facility or service;
- Quality of travel, users' perceptions of travel on a transportation facility or service with respect to their expectations;
- Accessibility, the ease with which travelers can engage in desired activities; and
- Capacity, the ability of a transportation facility or service to meet the quantity of travel demanded of it.



Quality of service for uncontrolled pedestrian crossings is covered in Chapter 20, which is based on pedestrian delay and is linked to a pedestrian's likelihood of risk taking behavior.

National Cooperative Highway Research Program (NCHRP) 562 – Improving Pedestrian Safety at Unsignalized Crossings

NCHRP 562 provides guidelines that can be used to select pedestrian crossing treatments for unsignalized intersections and mid-block locations based on data collected and analyzed through the research study. The guidelines are based on pedestrian volume, street crossing width, speed and traffic volume. The recommendations include a marked crosswalk, enhanced/high-visibility/"active when present" traffic control device, red signal or beacon device and a conventional traffic control signal. The report also provides a spreadsheet that can be used to determine the appropriate pedestrian crossing treatment per their recommendations. In addition to the guidance on pedestrian crossing treatments, NCHRP 562 also provides modifications to the MUTCD signal warrants for pedestrian volume, which are difficult to meet in many cases.

NCHRP 562 was developed with two main objectives:

- Identify pedestrian crossing treatments to improve safety for pedestrians crossing high-volume and high-speed roadways at unsignalized locations.
- Recommend modifications to the MUTCD pedestrian traffic signal warrant guidance.

Revised Code of Washington (RCW)

The Revised Code of Washington (RCW) is a compilation of the current laws in the state of Washington. Title 46 relates to motor vehicle laws and Title 61 is specific to rules of the road. Several RCWs apply to pedestrian crossings, as described in Table 1.



Table I. RCWs pertaining to pedestrian crossings

RCW Number	Name	Description
46.61.065	Flashing signals	<p>Whenever an illuminated flashing red or yellow signal is used in a traffic sign or signal it shall require obedience by vehicular traffic as follows:</p> <ul style="list-style-type: none"> ■ FLASHING RED (STOP SIGNAL) – vehicles shall stop at a clearly marked stop line, but if none, before entering a marked crosswalk on the near side of the intersection, or, if none, then at the point nearest the intersecting roadway where the driver has a view of approaching traffic on the intersecting roadway before entering the intersection, and the right to proceed shall be subject to the rules applicable after making a stop at a stop sign. ■ FLASHING YELLOW (CAUTION SIGNAL) – vehicles may proceed through the intersection with caution.
46.61.230	Pedestrians subject to traffic regulations	Pedestrians shall be subject to traffic-control signals at intersections
46.61.235	Crosswalks	<ul style="list-style-type: none"> ■ Vehicles shall stop and remain stopped to allow a pedestrian or bicycle to cross the roadway within an unmarked or marked crosswalk when the pedestrian or bicycle is upon or within one lane of the half of the roadway upon which the vehicle is traveling or onto which it is turning. For purposes of this section "half of the roadway" means all traffic lanes carrying traffic in one direction of travel, and includes the entire width of a one-way roadway. ■ Pedestrians and bicyclists shall not suddenly leave a curb or other place of safety and move into the path of a vehicle which is so close that it is impossible for the driver to stop. ■ Vehicles are not allowed to pass when a vehicle is stopped at a crosswalk for a pedestrian or bicyclist to cross the roadway
46.61.240	Crossing at other than crosswalks	<ul style="list-style-type: none"> ■ Pedestrians crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to vehicles. ■ Where curb ramps exist at or adjacent to intersections or at marked crosswalks, disabled persons may enter the roadway from the curb ramps and cross the roadway within or as closely as practicable to the crosswalk. ■ Pedestrians shall not cross at any place between adjacent signalized intersections except for a marked crosswalk. ■ Pedestrians shall not cross a roadway intersection diagonally unless authorized by official traffic-control devices. ■ Pedestrians shall not cross a roadway at an unmarked crosswalk where an official sign prohibits such crossing.



RCW Number	Name	Description
46.61.245	Drivers to exercise care	Drivers shall exercise due care to avoid colliding with any pedestrian upon any roadway
46.61.261	Sidewalks, crosswalks – Pedestrians, bicycles	Bicyclists shall yield right-of-way to a pedestrian on a crosswalk

Washington Administrative Code (WAC)

The Washington Administrative Code (WAC) amends the MUTCD to comply with laws and policies specific to the Revised Code of Washington (the RCWs). These amendments for pedestrian crossings are listed in Table 2.

Table 2. WACs pertaining to pedestrian crossings

WAC Number	Name	Description
468-95-033	In-street pedestrian crossing sign (R1-6a)	<u>MUTCD Section 2B.12</u> Amends the MUTCD regarding in-street pedestrian crossing signs to remove the ‘yield to pedestrians’ option and keeps the ‘stop for pedestrians’ option. Deletes signs R1-5, R1-5a, R1-6, and R1-9 from Figure 2B-2.
468-95-230	Crosswalk markings	<u>MUTCD Section 3B.18</u> Amends the MUTCD regarding the crosswalk marking patterns.
468-95-360	Crosswalk markings	<u>MUTCD Section 7C.02</u> Amends the MUTCD regarding the crosswalk marking patterns.

Washington State Department of Transportation (WSDOT) Traffic Manual and Sign Fabrication Manual

The WSDOT Traffic Manual provides guidance on pedestrian crossings, crosswalk specifications and standard details for crosswalks and stop lines (see Chapter 3). The WSDOT Sign Fabrication Manual provides fabrication details to maintain uniformity in appearance of signs.

Clark County Code

The Clark County Code is a codification of the general ordinances of Clark County, Washington. Title 10, vehicles and traffic, Title 12, streets and roads, and Title 40, unified development code, all include information regarding pedestrian crossings.

Clark County Standard Details

The Clark County Standard Details are provided for constructing various projects within the county. The details include roadway, drainage, sidewalk, and development and have been grouped according to specific construction categories. There are Clark County Standard Details for signing and striping.



Clark County School Zone Traffic Control Policy

The Clark County School Zone Traffic Control Policy, approved in 2016, provides clear guidance on the implementation of school zone traffic control under various sets of conditions. The policy provides assessments for when school crossings, reduced school speed zones, school areas, and school zone flashers should be implemented. Additionally, the policy includes details regarding signing, striping and illumination requirements.



CHAPTER 3: PEDESTRIAN CROSSING TREATMENTS

This policy is intended to inform and guide developers, and County staff the triggers, considerations, and requirements associated with implementing pedestrian crossing treatments within Clark County. The following three-step decision process guides the consideration and selection of pedestrian crossing treatments:

1. **Pedestrian Crossing Treatment Decision Trees:** The first decision point determines the potential for pedestrian crossing treatments, depending upon if the location is currently uncontrolled, controlled, or near a school.
2. **Enhanced Crossing Treatment Selection Table:** The outcome of the applicable decision tree may direct the user to the Enhanced Crossing Treatment Selection Table. The selection table determines an appropriate crossing treatment, including a marked crosswalk only, flashing beacons, a raised pedestrian refuge island, a pedestrian hybrid beacon, traffic signal or a combination of the above.
3. **Pedestrian Crossing Toolbox Cut Sheets:** The toolbox includes signing, striping, and design considerations for various pedestrian crossing treatments to assist in facility implementation.

3.1 Pedestrian Crossing Treatment Decision Trees

The first decision point assists in determining the potential need for pedestrian crossing treatments at an existing crosswalk or a proposed pedestrian crossing location based on a series of criteria. The existing traffic control at the crossing location and proximity to a school (e.g., uncontrolled, controlled, or near a school) determines which decision tree to use. An uncontrolled location can be at an intersection or mid-block. A controlled location can be a signal, roundabout, or at a stop sign. A school crosswalk can be adjacent to school grounds or shown on a school route plan.

There are three decision trees: uncontrolled crossings, controlled crossings, and school crosswalks:

- Uncontrolled locations – see Figure 3
- Controlled locations – see Figure 4
- Locations near a school – see Figure 5

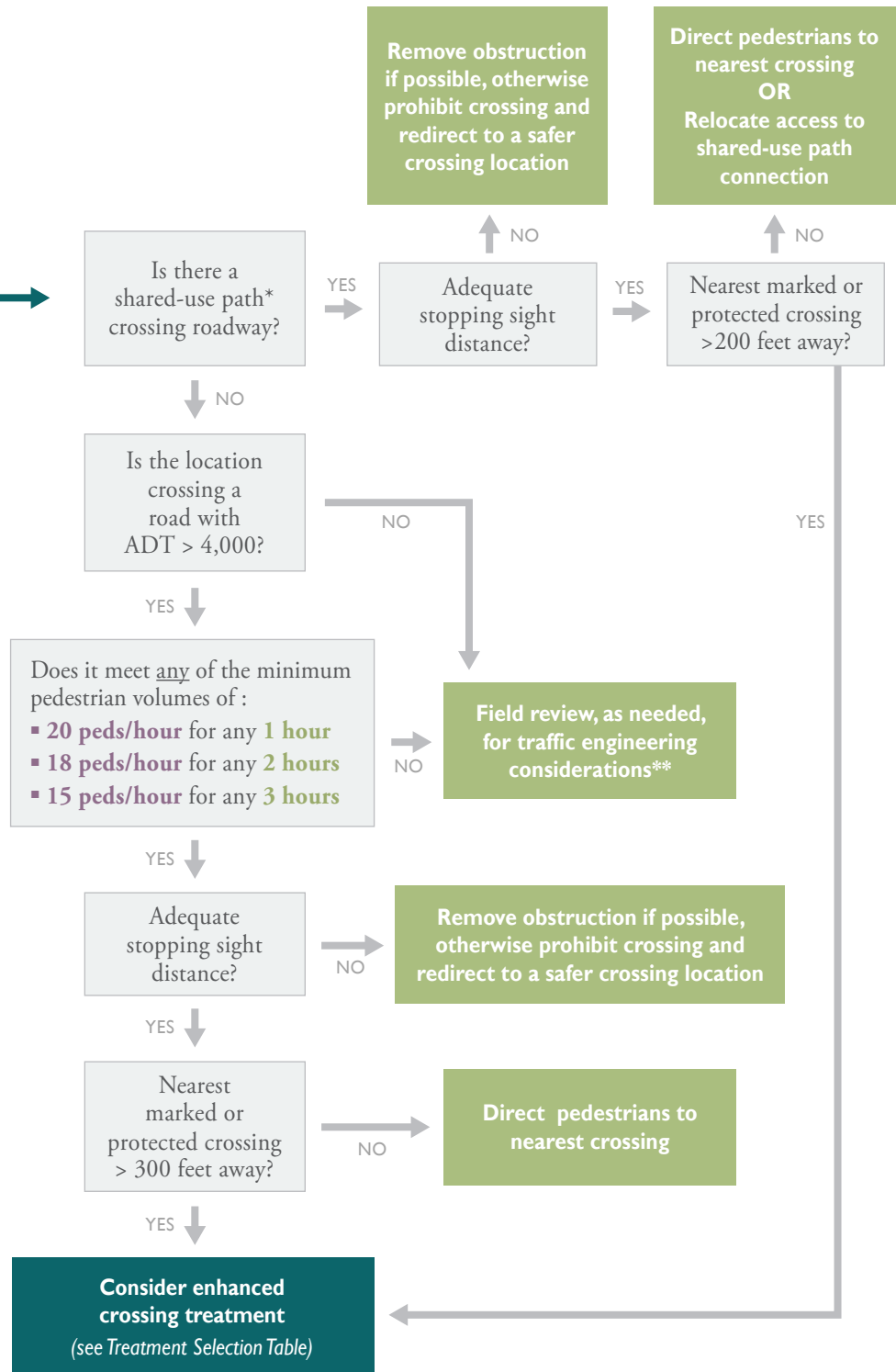
An evaluation worksheet for each type of crossing location is provided in Appendix B to help collect field data to identify what type of crossing treatment is appropriate based on the evaluation criteria. One outcome from the decision trees is to move on to Step 2 of the decision process, to see the Enhanced Crossing Treatment Selection Table (Figure 6).





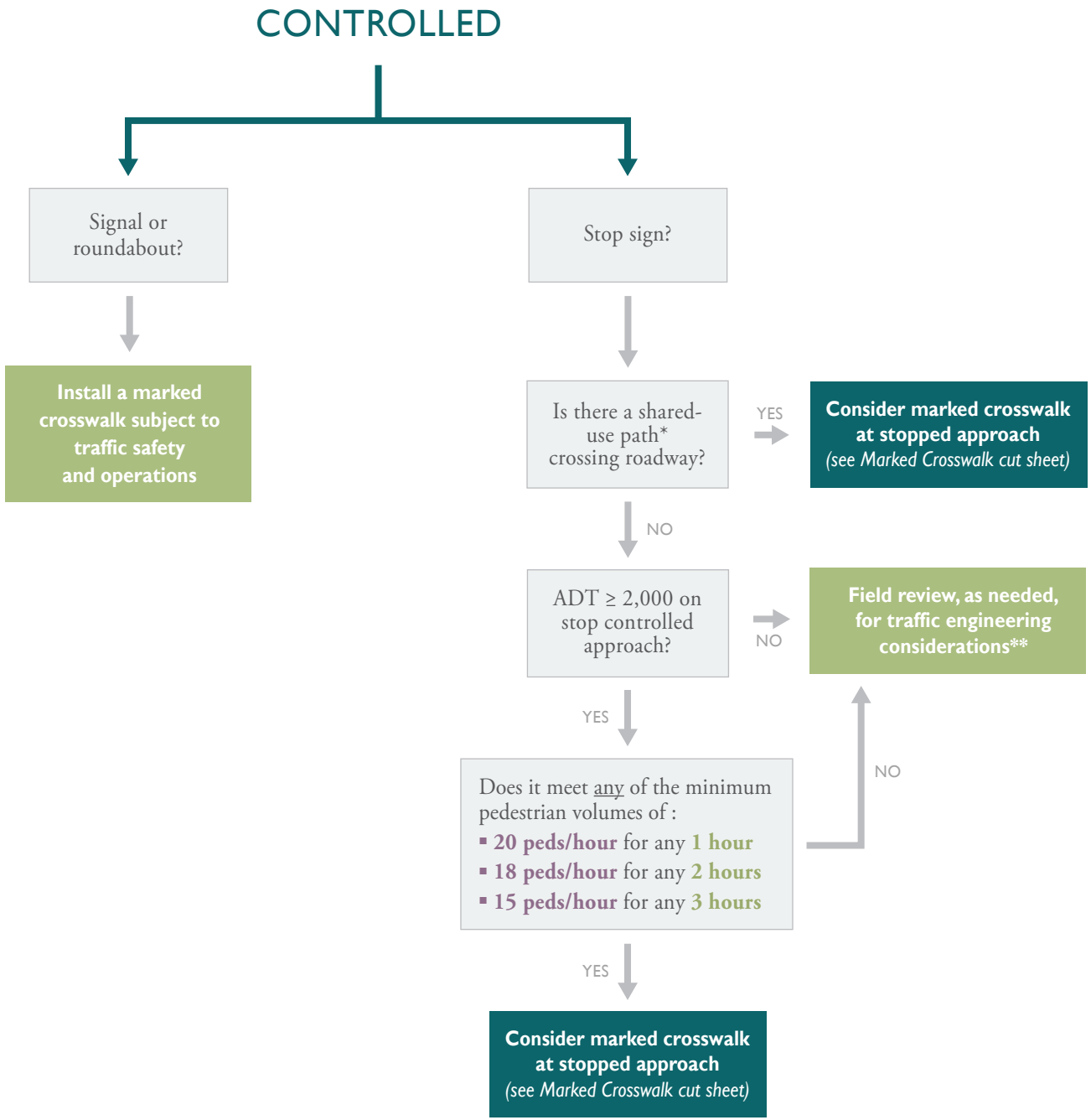
UNCONTROLLED CROSSING DECISION TREE - Figure 3

UNCONTROLLED (INTERSECTION/ MIDBLOCK)



* Shared-use path defined as a public facility separated from motorized vehicular traffic for bicyclists and pedestrians.

** Traffic engineering considerations include, but are not limited to the following: pedestrian activity, vehicle turning movements, speed, crossing distance, and crash history.

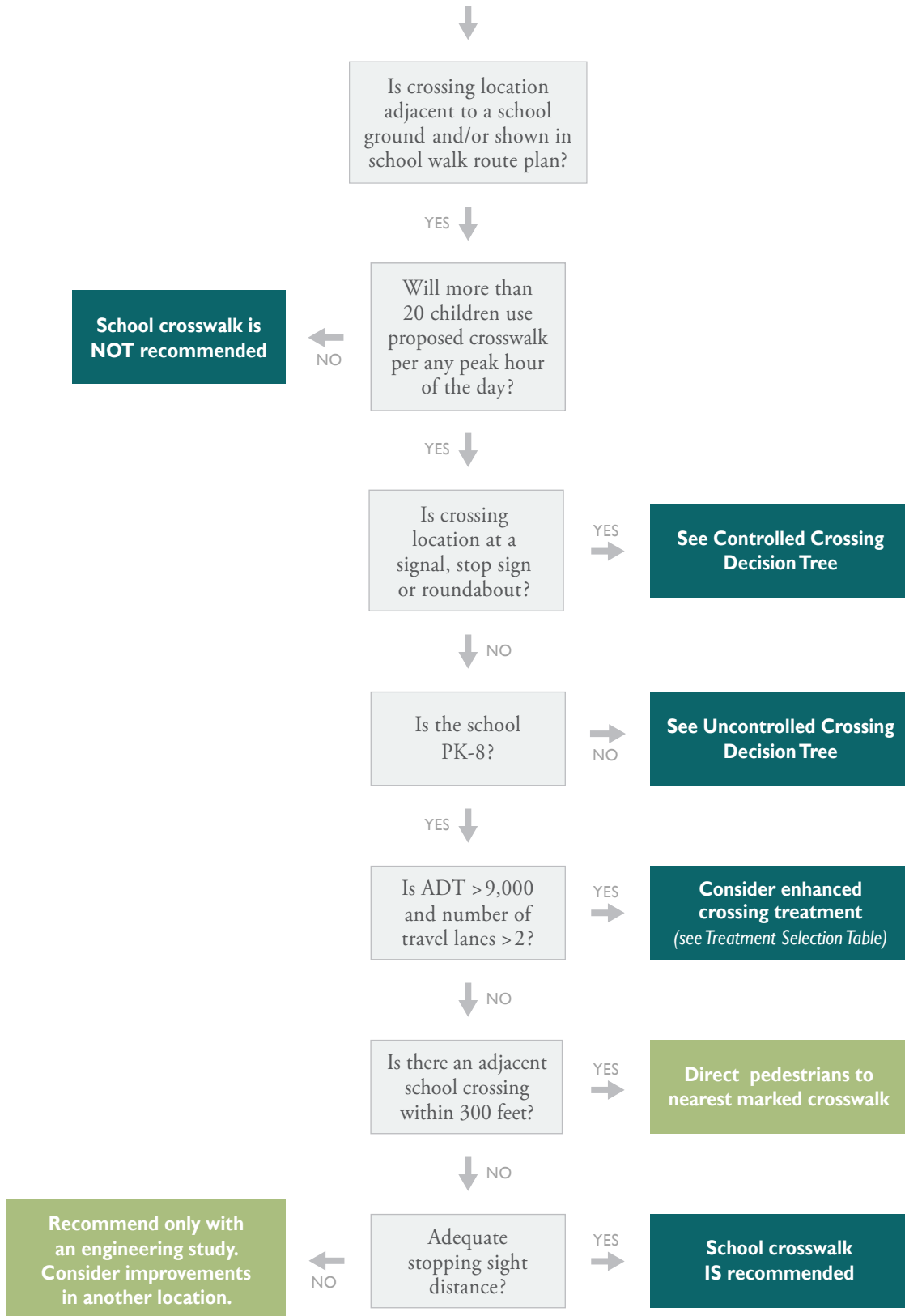


* Shared-use path defined as a public facility separated from motorized vehicular traffic for bicyclists and pedestrians.

** Traffic engineering considerations include, but are not limited to the following: pedestrian activity, vehicle turning movements, speed on stop controlled, approach, and crash history.



CRITERIA PER CLARK COUNTY SCHOOL ZONE TRAFFIC CONTROL POLICY



3.2 Enhanced Crossing Treatment Selection Table

The Enhanced Crossing Treatment Selection Table (Figure 6) was developed based upon peer cities, the Zeeger table, and delay analysis from the Highway Capacity Manual.⁴ The HCM pedestrian delay was the primary influence on the selection table recommendations, the results of which are shown in Appendix C. The delay analysis evaluated a set of typical pedestrian crossings to determine delay thresholds to assist in the selection of the appropriate crossing treatment. A delay threshold of 30 seconds was used where only a marked crosswalk at an existing unmarked location would be sufficient.

The outcomes from the selection table include a marked crosswalk, flashing beacons, a raised pedestrian refuge island, a pedestrian hybrid beacon, or traffic signals. For each of those facilities, see the Pedestrian Crossing Toolbox Cut Sheets for further details on implementation.

The selection table shown in Figure 6 provides a preliminary recommendation, but requires a follow-up engineering study for the final treatment selection. The engineering study needs to account for factors such as sight distance, traffic safety, traffic operations, pedestrian population, and other field conditions. Additionally, a site-specific delay analysis using the HCM and field observation of gaps in traffic stream is required before a final treatment is selected.

3.3 Pedestrian Crossing Toolbox Cut Sheets

The following Pedestrian Crossing Cut Sheets provide implementation guidance on each of the different potential enhanced pedestrian crossing treatments. The Pedestrian Crossing Toolbox includes details about signing, striping, and design considerations for the following pedestrian crossing treatments:

- Marked Crosswalks (with and without an island) – see Figure 7
- Flashing Beacons (with and without an island) – see Figure 8
- Pedestrian Hybrid Beacons (with and without an island) – see Figure 9

⁴ Highway Capacity Manual, 6th Edition, Chapter 20 Two-Way Stop Controlled Intersections: Pedestrian Mode, 2016





ENHANCED CROSSING TREATMENT SELECTION TABLE - Figure 6

IF THE
DECISION TREE
OUTCOME WAS

**CONSIDER ENHANCED
CROSSING TREATMENT**

THEN REFER TO THIS SELECTION TABLE

RECOMMENDATIONS FOR MARKED CROSSWALKS AND ENHANCED
PEDESTRIAN CROSSING TREATMENTS AT UNCONTROLLED LOCATIONS

ROADWAY TYPE (NUMBER OF TRAVEL LANES)	VEHICLE ADT > 4,000 TO 6,000			VEHICLE ADT > 6,000 TO 9,000			VEHICLE ADT > 9,000 TO 12,000			VEHICLE ADT > 12,000 TO 15,000			VEHICLE ADT > 15,000		
	SPEED LIMIT														
	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH
2 Lanes	A	A	B	B	B	B	B	B	B	B	B	E	B	B	E
3 Lanes	A	A	B	C	C	D	C	D	D	C	D	E	D	D	E
Multi-Lane (4 or more Lanes)	C	C	C	C	C	D	C	D	E	D	D	E	D	D	E

NOTES:

- Shared-use path crossing locations with ADT less than 4,000 ADT may qualify for marked crosswalks and/or enhanced pedestrian crossing treatments as shown in the column for "Vehicle ADT >4,000 to 6,000."
- Installation of marked crosswalk or enhanced crossing treatment, at any location, subject to engineering study and judgement that accounts for factors such as sight distance, traffic safety, traffic operations, other field conditions and pedestrian population. The engineering study must include a site-specific delay analysis, using the HCM.

LEGEND

- A** Marked Crosswalk
- B** Marked Crosswalk with Flashing Beacon
- C** Marked Crosswalk with Median Island
- D** Marked Crosswalk with Flashing Beacon and Median Island
- E** Marked Crosswalk with Pedestrian Hybrid Beacon (PHB) or Traffic Signal

REFERENCES:

- Zegeer, Steward, Huang, "Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines", FHWA, 2002.
- Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition, published by FHWA.
- Highway Capacity Manual (HCM), 2016 sixth edition, published by TRB.



MARKED CROSSWALK - Figure 7



MARKED CROSSWALKS

Marked crosswalks direct pedestrians to cross the street at a designated location either at intersections or midblock locations. Crosswalk markings are typically 8 feet wide, ladder-style, and are clearly marked and signed (see *Clark County Standard Detail T3.0*). They can be installed on either two-lane or multi-lane roadways, as justified by an engineering study. Conceptual road sections with typical marked crosswalk signage and striping are shown below.

SIGNING + STRIPING

A At Crosswalk

W11-2 OR W11-15 for designated trail crossing OR SI-1 for school crossing

W16-7P (L/R)

B At Stop Line

RI-5b (only use with stop line pavement marking)

C No Parking Sign (if applicable)

R7-IR (25' beyond crosswalk) NO PARKING ANY TIME R7-IL

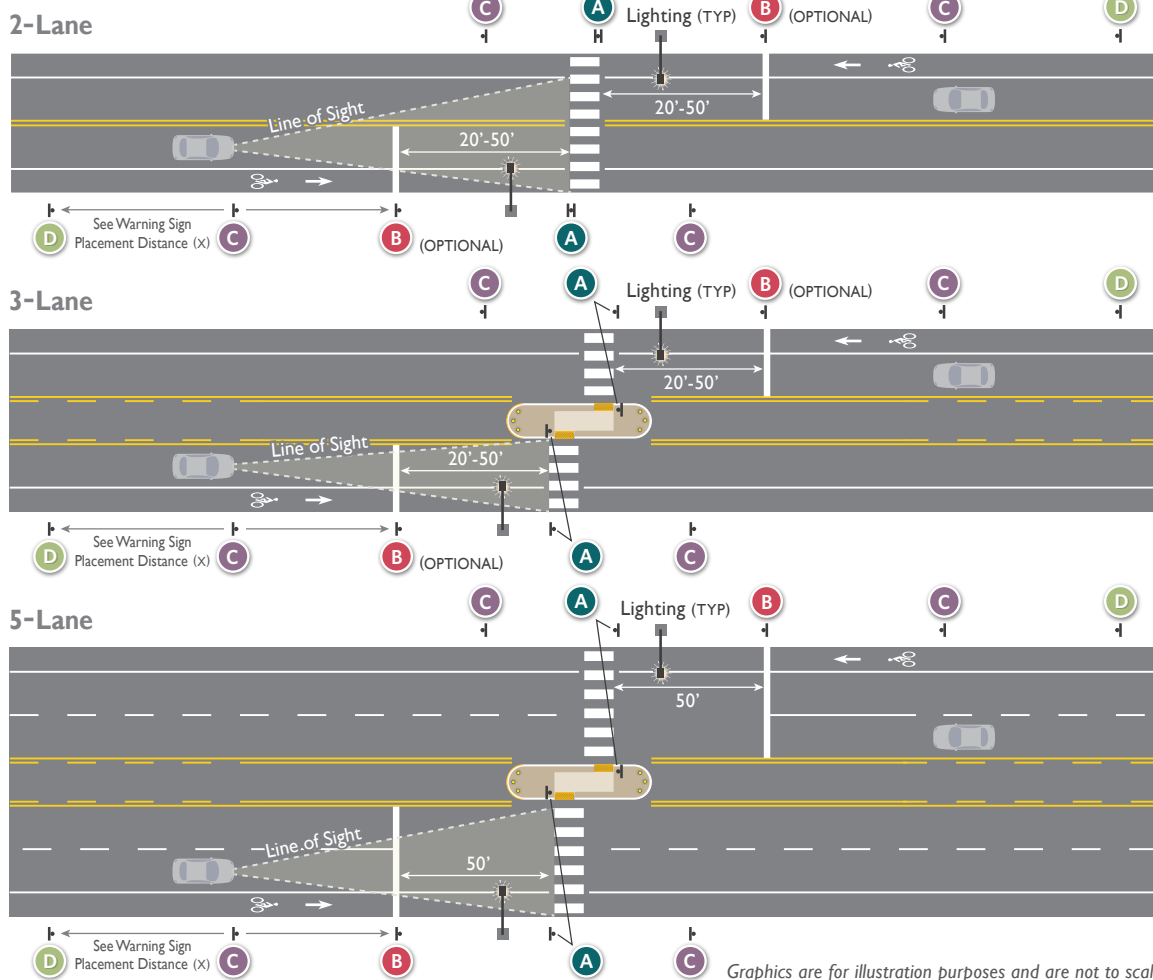
D Warning Sign

W11-2 OR W11-15 for designated trail crossing OR SI-1 for school crossing

with AHEAD W16-9P

Speed (MPH)	Warning Sign Placement Distance (X) Feet
25-40	150
45	175
50	250

Note: Based on the 2009 MUTCD, Table 2C-4, and modified based on Clark County practice



STOPPING SIGHT DISTANCE

The available stopping sight distance should be sufficiently long to enable a vehicle traveling at the posted speed listed to stop before reaching the stop line or prior to the crosswalk. A pedestrian crossing shall only be installed if the minimum sight distance to the stopping location is achieved. On-street parking or sight obstructions should be removed in stopping line of sight.

Posted Speed (mph)	Stopping Sight Distance (SSD) ¹
25	210 ft
30	265 ft
35	325 ft
40	390 ft
45	460 ft
50	535 ft

¹ Typical condition is the warning of a potential stop situation. The distances are based on the 2011 AASHTO "Green Book," Table 3-1, Stopping Sight Distance, with a modified brake reaction time of 4.0 seconds, to account for longer detection time.

LIGHTING

Illuminate the entire midblock pedestrian crossing, including any refuge area in the roadway, and the sidewalks or shoulders adjacent to the crosswalk per the current WSDOT Design Manual, Chapter 1040. Lighting analysis should be performed to confirm that light levels will meet the standards listed below. Emphasis should be placed on positive lighting of the pedestrians in the crosswalk and on the adjacent sidewalks.

FROM WSDOT DESIGN MANUAL EXHIBIT 1040-22: LIGHT LEVELS AND UNIFORMITY RATIOS

Pedestrian / Area Classification (footcandles)	Minimum Average Maintained Horizontal Light Level			Maximum Uniformity Ratio ²	Maximum Veiling Luminance Ratio ³
	High	Medium	Low		
Midblock pedestrian crossing	2.0	2.0	2.0	4:1	0.3:1
Highways without full access control – intersections	1.2	0.9	0.9	4:1	0.3:1

² Minimum Average Maintained Light Level / Minimum Light Level = Maximum Uniformity Ratio

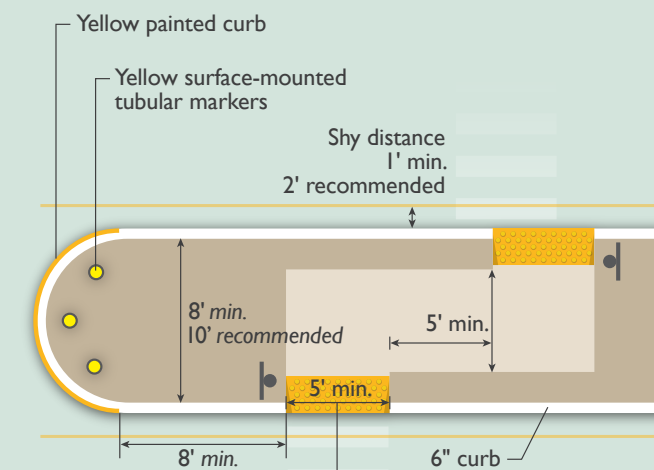
³ Maximum Veiling Luminance / Average Luminance = Veiling Luminance Ratio

Note:

Both midblock and intersection – different areas covered (see Exhibit 1040-B for intersection)

MEDIAN ISLAND WITH PEDESTRIAN REFUGE DETAIL

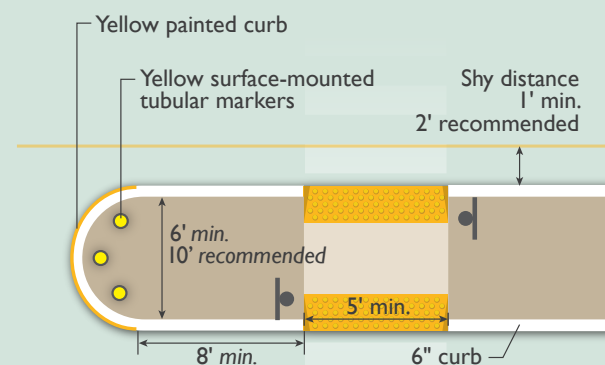
Preferred Option



Minimum width of 5 feet to ensure a passing space is provided.

Pedestrian access routes of multi-use paths that go through raised medians shall be the same width as the multi-use path.

Alternate Option



REFERENCE

WSDOT Design Manual, Exhibit 1510-22



FLASHING BEACON - Figure 8



FLASHING BEACONS

Flashing beacons are user-actuated amber LEDs that accentuate warning signs at uncontrolled pedestrian crossings. They are manually activated by pedestrians pushing a button. Flashing beacons comply with the MUTCD. WSDOT provides a standard detail (IS-22) for flashing beacon configuration. Conceptual road sections with typical marked crosswalk signage and striping are shown below.

SIGNING + STRIPING

A At Crosswalk

W11-2 OR W11-15 for designated trail crossing OR SI-1 for school crossing

with Flashing Beacons AND W16-7P (L/R)

B At Stop Line

RI-5b (only use with stop line pavement marking)

C No Parking Sign (if applicable)

R7-1R (25' beyond crosswalk) NO PARKING ANY TIME R7-1L

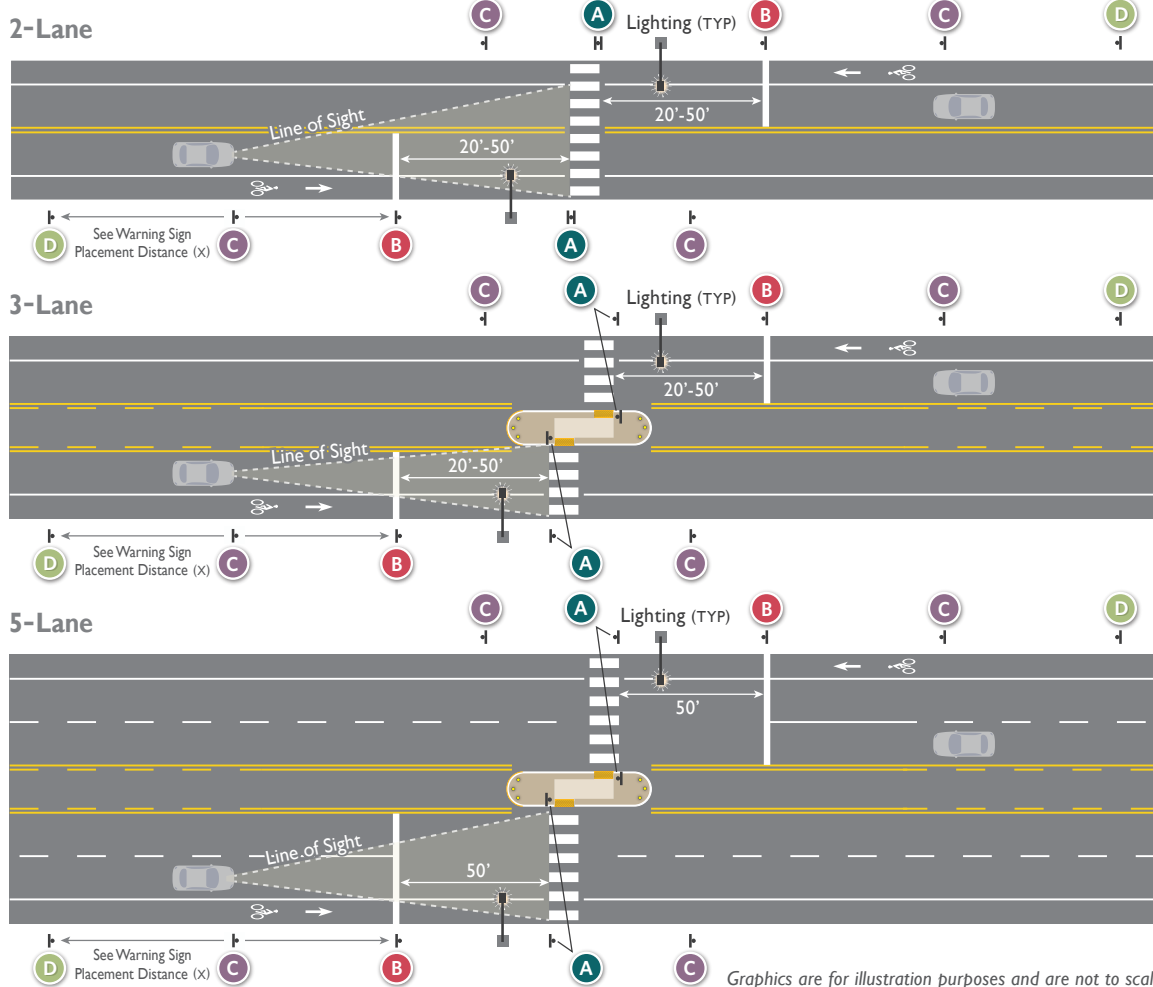
D Warning Sign

W11-2 OR W11-15 for designated trail crossing OR SI-1 for school crossing

with AHEAD W16-9P

Speed (MPH)	Warning Sign Placement Distance (X) Feet
25-40	150
45	175
50	250

Note: Based on the 2009 MUTCD, Table 2C-4, and modified based on Clark County practice



STOPPING SIGHT DISTANCE

The available stopping sight distance should be sufficiently long to enable a vehicle traveling at the posted speed listed to stop before reaching the stop line. A midblock pedestrian crossing shall only be installed if the minimum sight distance to the stopping location is achieved. On-street parking or sight obstructions should be removed in stopping line of sight.

Posted Speed (mph)	Stopping Sight Distance (SSD) ¹
25	155 ft
30	200 ft
35	250 ft
40	305 ft
45	360 ft
50	425 ft

¹ Typical condition is the warning of a potential stop situation. The distances are based on the 2011 AASHTO "Green Book," Table 3-1, Stopping Sight Distance.

LIGHTING

Illuminate the entire midblock pedestrian crossing, including any refuge area in the roadway, and the sidewalks or shoulders adjacent to the crosswalk per the current WSDOT Design Manual, Chapter 1040. Lighting analysis should be performed to confirm that light levels will meet the standards listed below. Emphasis should be placed on positive lighting of the pedestrians in the crosswalk and on the adjacent sidewalks.

FROM WSDOT DESIGN MANUAL EXHIBIT 1040-22: LIGHT LEVELS AND UNIFORMITY RATIOS

Pedestrian / Area Classification (footcandles)	Minimum Average Maintained Horizontal Light Level			Maximum Uniformity Ratio ²	Maximum Veiling Luminance Ratio ³
	High	Medium	Low		
Midblock pedestrian crossing	2.0	2.0	2.0	4:1	0.3:1
Highways without full access control – intersections	1.2	0.9	0.9	4:1	0.3:1

² Minimum Average Maintained Light Level / Minimum Light Level = Maximum Uniformity Ratio

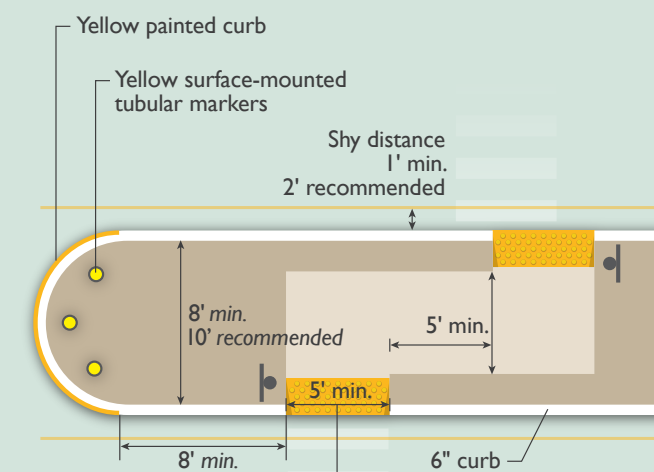
³ Maximum Veiling Luminance / Average Luminance = Veiling Luminance Ratio

Note:

Both midblock and intersection – different areas covered (see Exhibit 1040-B for intersection)

MEDIAN ISLAND WITH PEDESTRIAN REFUGE DETAIL

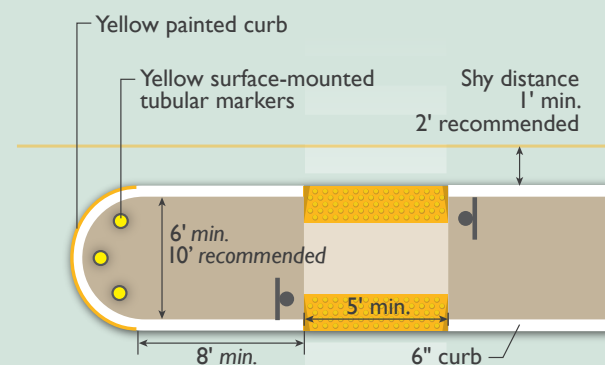
Preferred Option



Minimum width of 5 feet to ensure a passing space is provided.

Pedestrian access routes of multi-use paths that go through raised medians shall be the same width as the multi-use path.

Alternate Option



REFERENCE

WSDOT Design Manual, Exhibit 1510-22



PEDESTRIAN HYBRID BEACON (PHB) - Figure 9

PEDESTRIAN HYBRID BEACONS

PHBs are user-actuated LEDs that illuminate when a pedestrian manually pushes a button. Upon activation, the LED illuminates a flashing yellow beacon then changes to solid yellow to communicate to drivers to prepare to stop. The beacon changes to a steady red once it is safe for a pedestrian to cross, followed by a flashing red during the pedestrian clearance interval. PHBs have FHWA official approval and can be installed on either a two-lane or multi-lane roadway, as long as they are installed 100 feet from a side street, and are justified by an engineering study. Conceptual road sections with typical marked crosswalk signage and striping are shown below.

SIGNING + STRIPING

A At Crosswalk

W11-2 OR W11-15 OR SI-1
for designated trail crossing OR for school crossing

R10-23* PHB signal

W16-7P (L/R)

B At Stop Line

STOP HERE ON RED R10-6

C No Parking Sign
(if applicable)

R7-1R (25' beyond crosswalk) OR R7-1L

D Warning Sign

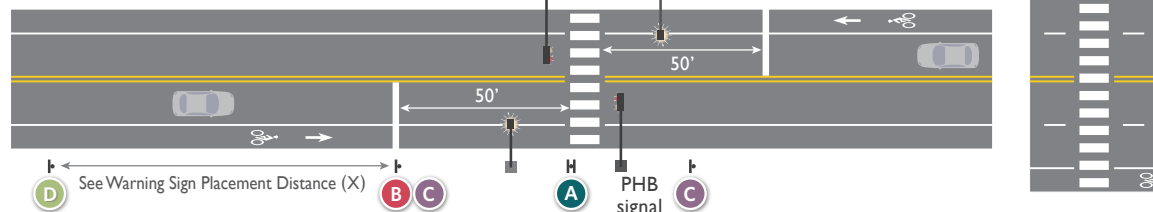
W11-2 OR W11-15 OR SI-1
for designated trail crossing OR for school crossing

with AHEAD W16-9P

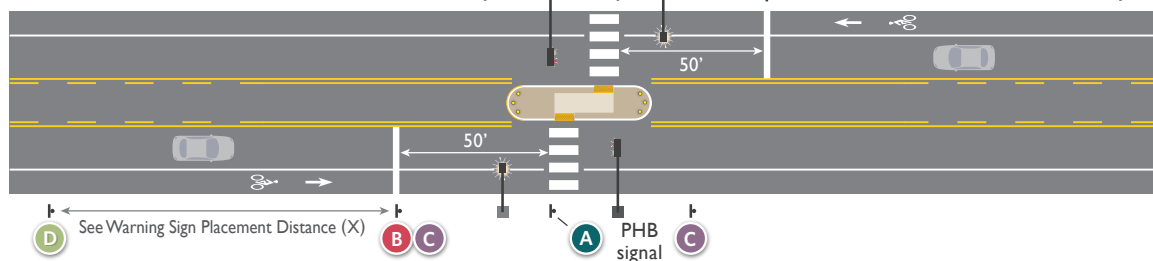
Speed (MPH)	Warning Sign Placement Distance (X) Feet
25-40	150
45	175
50	250

Note:
Based on the 2009 MUTCD, Table 2C-4, and modified based on Clark County practice

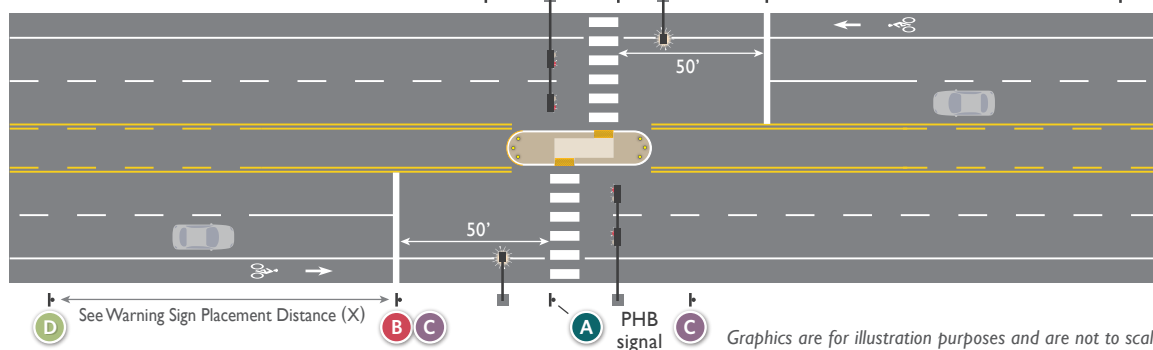
2-Lane (Similar signage for 4-Lane)



3-Lane



5-Lane



SIGNAL VISIBILITY SIGHT DISTANCE

The sight distance for visibility of signal indications to approaching traffic should be sufficiently long to enable a vehicle traveling to stop before reaching the stop line. The minimum sight distance for signal visibility is the sum of stopping sight distance plus an assumed queue length.

Posted Speed (mph)	Minimal Sight Distance for Signal Visibility ¹
25	215 ft
30	270 ft
35	325 ft
40	390 ft
45	460 ft
50	540 ft

¹ Distances are based on the 2009 MUTCD, Table 4D-2.

LIGHTING

Illuminate the entire midblock pedestrian crossing, including any refuge area in the roadway, and the sidewalks or shoulders adjacent to the crosswalk per the current WSDOT Design Manual, Chapter 1040. Lighting analysis should be performed to confirm that light levels will meet the standards listed below. Emphasis should be placed on positive lighting of the pedestrians in the crosswalk and on the adjacent sidewalks.

FROM WSDOT DESIGN MANUAL EXHIBIT 1040-22: LIGHT LEVELS AND UNIFORMITY RATIOS

Minimum Average Maintained Horizontal Light Level	Pedestrian / Area Classification (footcandles)			Maximum Uniformity Ratio ²	Maximum Veiling Luminance Ratio ³
	High	Medium	Low		
Midblock pedestrian crossing	2.0	2.0	2.0	4:1	0.3:1
Highways without full access control – intersections	1.2	0.9	0.9	4:1	0.3:1

² Minimum Average Maintained Light Level / Minimum Light Level = Maximum Uniformity Ratio

³ Maximum Veiling Luminance / Average Luminance = Veiling Luminance Ratio

Note:

Both midblock and intersection – different areas covered (see Exhibit 1040-B for intersection)

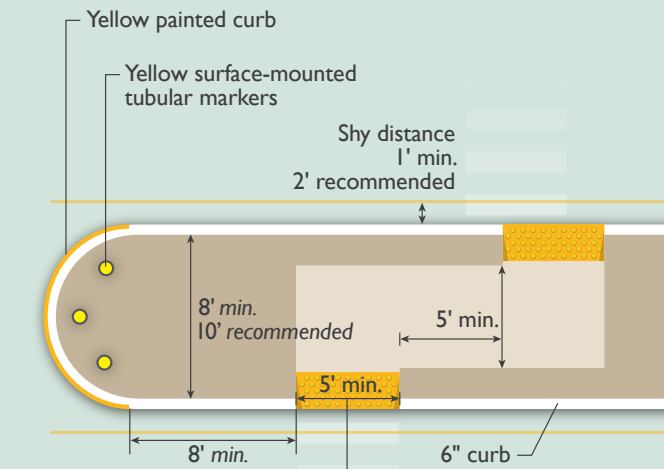
PHB SIGNAL



* This sign can be used in place of R10-23 for educational purposes for the first 3 years after installation

MEDIAN ISLAND WITH PEDESTRIAN REFUGE DETAIL

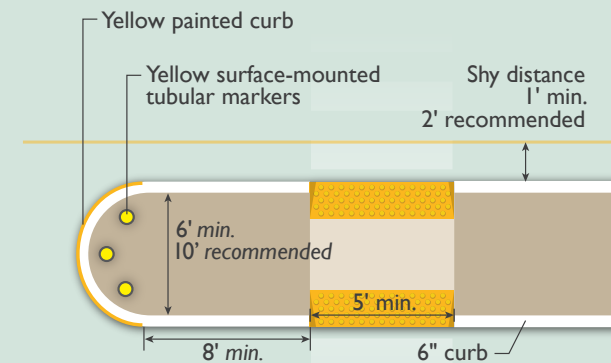
Preferred Option



Minimum width of 5 feet to ensure a passing space is provided.

Pedestrian access routes of multi-use paths that go through raised medians shall be the same width as the multi-use path.

Alternate Option



REFERENCE

WSDOT Design Manual, Exhibit 1510-22

Appendix A: Enhanced Pedestrian Crossing Treatment Decision Tool Memo

Memo

Date: Friday, September 29, 2017

Project: Clark County Pedestrian Crossing Treatment Guidelines

To: Courtney Furman & Ejaz Khan, Clark County

From: Tom Shook, HDR

Subject: Revised Draft Enhanced Pedestrian Crossing Treatment Decision Tool Memo

Introduction and Purpose

Clark County, Washington has been experiencing an increased demand for pedestrian facilities. As demand for pedestrian mode of travel continues to increase, the County is committed to provide infrastructure for seamless network and efficient movement of pedestrians, including a variety of pedestrian crossing treatments. Pedestrian crossings that safely connect pedestrian facilities to various origins and destinations are a key component in providing pedestrian infrastructure.

Clark County wishes to develop decision-making guidelines to determine appropriate pedestrian crossing treatments best suited for each location. The purpose of this memo is to provide background in the development of the **enhanced pedestrian crossing treatment decision tool** for Clark County. The guidelines consider a series of national best practices and peer agency review to provide background and influence into the development to the County's tool. This memo includes the following:

- Review of three national best practice guidelines pertaining to pedestrian crossing treatment warrants, including the MUTCD, NCHRP 562, and the "Zegeer Table" that includes specific criteria for selection of different types of pedestrian crossing treatments.
- Summaries of three peer agencies with adopted pedestrian crosswalk decision tools to provide background for the development of Clark County's decision tool, including City of Portland, OR Bureau of Transportation (PBOT), City of Boulder, CO, and Virginia Department of Transportation (VDOT).
- A draft enhanced pedestrian crossing decision tool catered to Clark County conditions utilizing research gathered from peer agencies and national best practices that provides objective guidelines through a two-step process using:
 1. A **pedestrian crossing treatment decision flow chart** to identify the need for an enhanced crosswalk at an existing unmarked location; and
 2. An **enhanced crossing treatment selection table** providing various treatment options if enhanced pedestrian treatments are appropriate at a location under consideration, using a set of evaluation criteria.

Best Practice Review

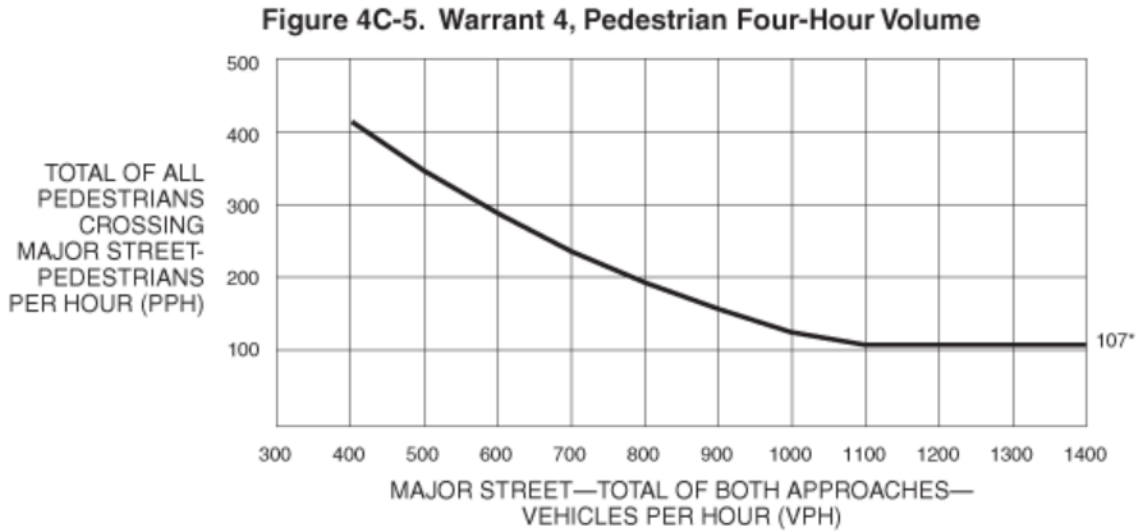
Manual on Uniform Traffic Control Devices (MUTCD)

The MUTCD sets standards and provides guidance on a variety of traffic control devices to ensure uniformity among traffic control throughout the United States. The MUTCD provides specific guidance on pedestrian control features and pedestrian signal warrants.

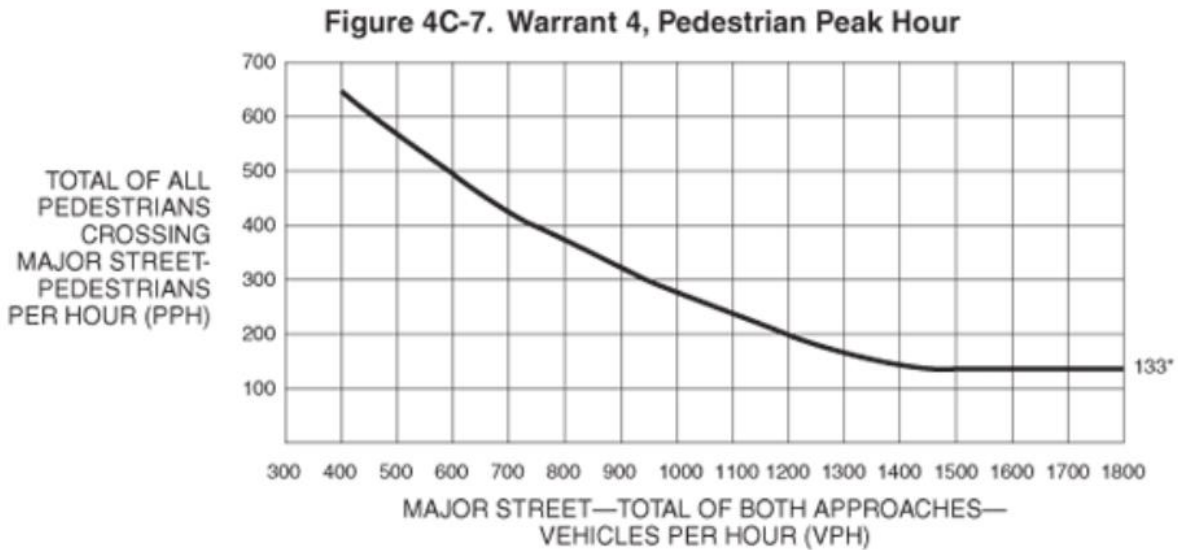
Pedestrian control features included in the MUTCD are standard markings, signage, and pedestrian signal control features (e.g., pedestrian signal heads, pedestrian interval timing, and pedestrian detectors) for use in providing safe and uniform treatment for pedestrians to cross roadways. The MUTCD provides a series of pedestrian signal warrants for use when considering installing a full signal for safe pedestrian crossing.

- **Traffic signal using pedestrian volumes (Warrant 4):** A full traffic signal may be warranted at a location depending on pedestrian crossing volumes and major street approach volumes where pedestrians experience excessive delay crossing the major street (for either 4-hour or peak hour volumes). This criteria should not be applied where the distance to the nearest traffic signal or stop sign is less than 300 feet. Figure 1 illustrates the 4-hour and peak hour pedestrian volume traffic signal warrant graphs. There is a 70% reduction that can be used if the speed limit or the 85th-percentile speed on the major street exceeds 35 miles per hour, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000.

Figure 1. MUTCD Traffic Signal Warrant using Pedestrian Volumes



*Note: 107 pph applies as the lower threshold volume.



*Note: 133 pph applies as the lower threshold volume.

Source: MUTCD, FHWA, 2009.

- Pedestrian hybrid beacon:** Should be examined at locations that do not meet full traffic signal warrants or a traffic signal installation is not feasible. Considers crosswalk length, pedestrian crossing volumes, and major street vehicle volumes for both low-speed roads (35 mph or less) and high-speed roads (greater than 35 mph). Figure 2

illustrates the peak hour hybrid beacon signal warrants for low- and high-speed roadways.

Figure 2. MUTCD Pedestrian Hybrid Beacon Warrants for Low- and High-Speed Roadways

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways

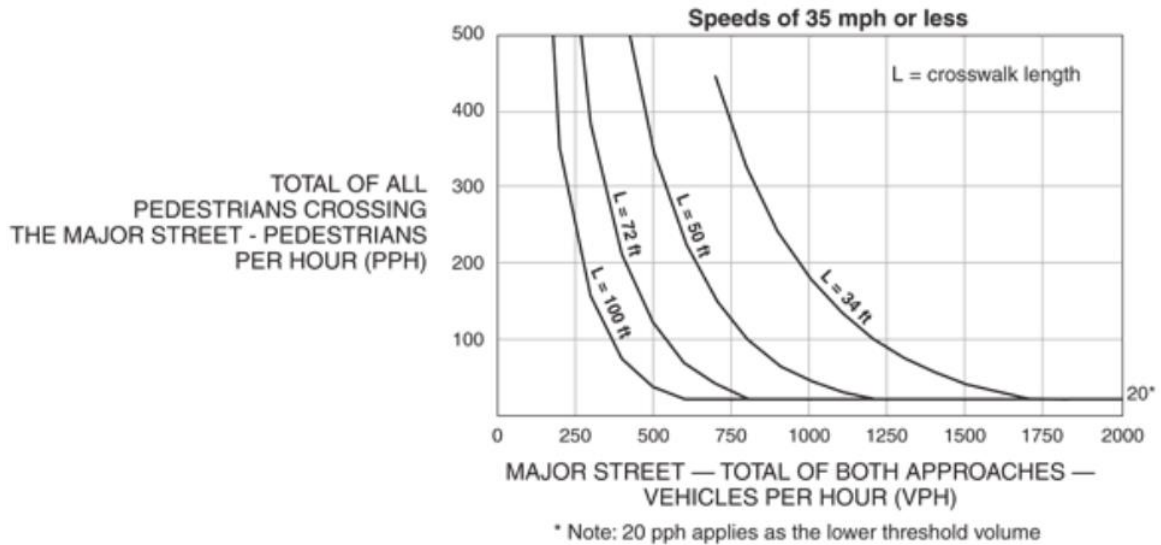
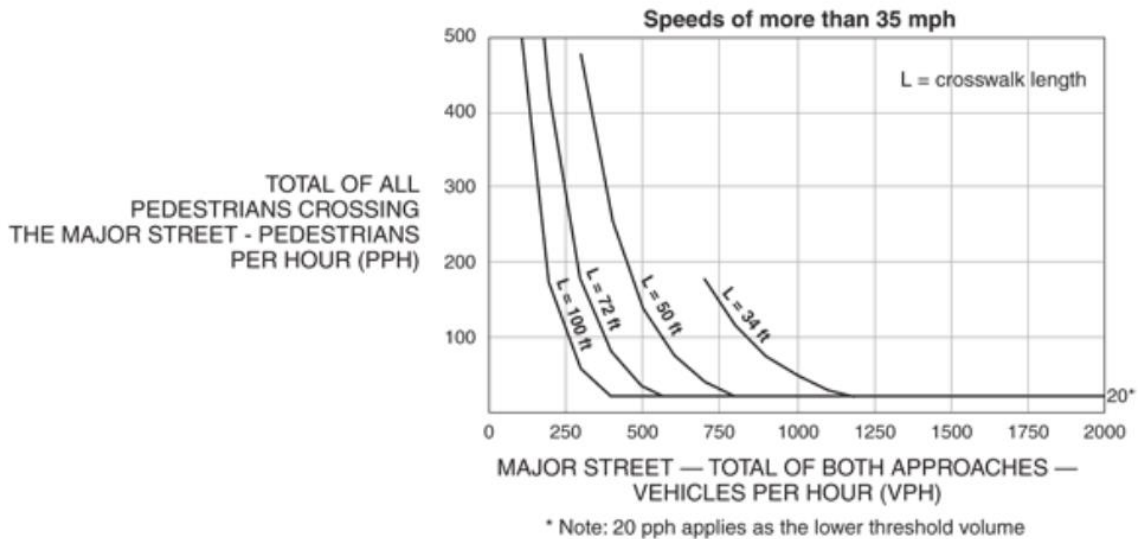


Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



Source: MUTCD, FHWA, 2009.



NCHRP 562

NCHRP 562 - *Improving Pedestrian Safety at Unsignalized Crossings* was developed with two main objectives:

- Identify pedestrian crossing treatments to improve safety for pedestrians crossing high-volume, high-speed roadways at unsignalized locations.
- Recommend modifications to the MUTCD pedestrian traffic signal warrant guidance discussed above.

Pedestrian Crossing Treatments

NCHRP 562 provides a series of enhanced pedestrian crossing treatments in addition to what is included in the MUTCD. Table 1 summarizes the list of treatment options recommended for enhanced pedestrian crossings. These types of treatments have been documented as successful in encouraging motorists to yield to pedestrians, especially on high volume streets.

Table 1. NCHRP 562 Pedestrian Crossing Treatments

Advance Signing	In-Roadway Warning Lights
Advance Stop Line and Sign	Pedestrian Crossing Flags
Median Refuge Island	Overhead Flashing Amber Beacons
Raised Crosswalk	Pedestrian Crosswalk Signal
Curb Extension	Half Signal
Roadway Narrowing	HAWK Beacon Signal
Marking and Crossing Signs	Pedestrian Beacon
In-Street Pedestrian Crossing Signs	Traffic Signal
High-Visibility Signs and Markings	

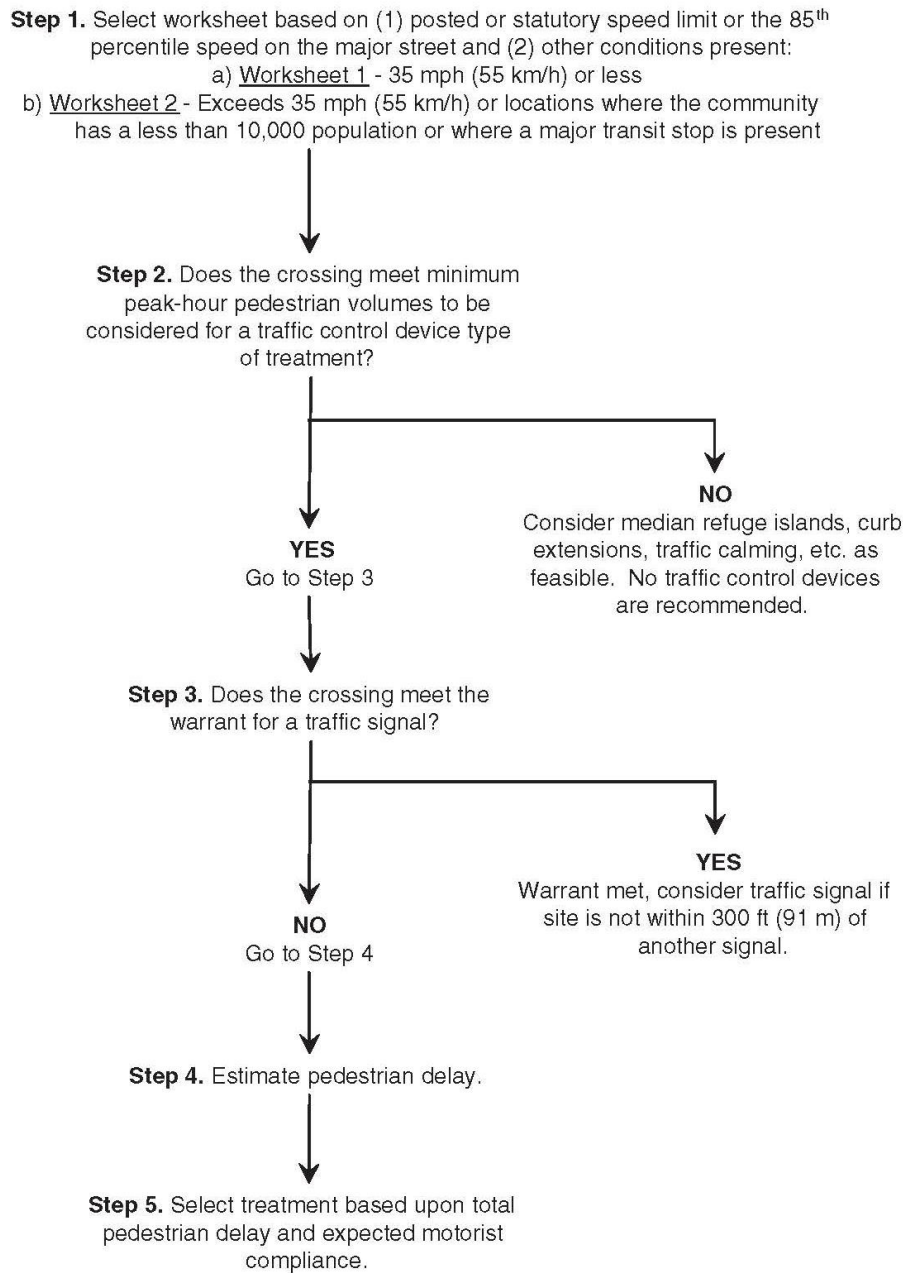
Source: NCHRP 562, *Improving Pedestrian Safety at Unsignalized Crossings*, 2006.

Refined Pedestrian Signal Warrant

NCHRP 562 provides modifications to MUTCD pedestrian signal warrants described above, including a more robust evaluation process, and guidance on additional enhanced pedestrian crossing treatments beyond what is included in the MUTCD. The NCHRP 562 Signal warrant process is described below and graphically represented in Figure 3:

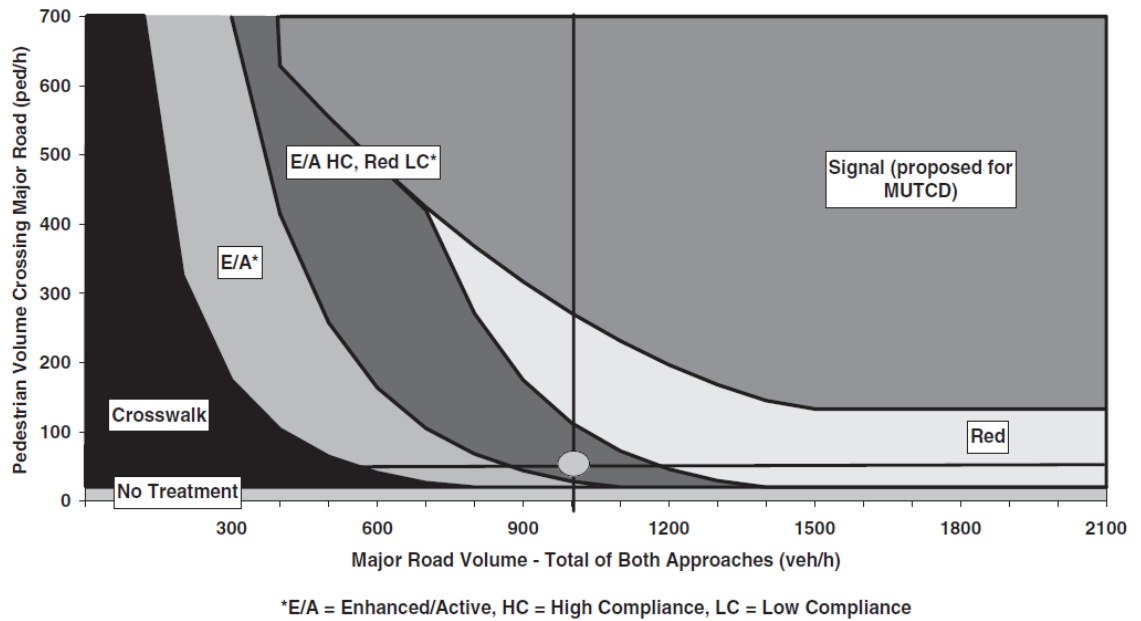
1. Select Worksheet, either low-speed (35 mph or less) or high-speed (over 35 mph)
2. Check minimum pedestrian volume, using peak-hour pedestrian counts and a minimum of 20 pedestrians per hour in both directions
3. Check MUTCD Signal Warrant
4. Estimate approach pedestrian delay, using the 2010 Highway Capacity Manual (HCM) methodology
5. Select appropriate treatment, using the total pedestrian delay and the results of the crossing warrant plot shown in Figure 4, using the following category guidance:
 - **No treatment:** no pedestrian treatment recommended
 - **Crosswalk:** Standard crosswalk using MUTCD striping guidance
 - **Enhanced:** Permanent warning signs, markings, and/or beacons to enhance the visibility of the crossing location and pedestrians using the crossing
 - **Active:** “Active when present” devices that display a warning only when a pedestrian is present
 - **Red:** Devices that display a circular red indicator at pedestrian locations
 - **Signal:** traffic control signal

Figure 3. NCHRP Pedestrian Crossing Treatment Guidelines Flowchart



Source: NCHRP 562, Improving Pedestrian Safety at Unsignalized Crossings, 2006.

Figure 4. NCHRP Pedestrian Crossing Warrant Plot



Source: NCHRP 562, Improving Pedestrian Safety at Unsignalized Crossings, 2006.

“ZEGEER TABLE”

Many of the agencies that have developed enhanced pedestrian facility selection tables adapted their criteria and structure on the “Zegeer Table” included in the *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations* sponsored by FHWA in 2002. Figure 5 details the “Zegeer Table”, which highlights enhanced pedestrian crossing actions using speed and traffic volume thresholds for various roadway types.



Figure 5. “Zegeer Table”

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT >9000 to 12,000			Vehicle ADT >12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h	≤ 30 mi/h	35 mi/h	40 mi/h
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

* These guidelines include intersection and midblock locations with no traffic signals or stop signs on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone **will not** make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. **These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.**

** Where the speed limit exceeds 40 mi/h (64.4 km/h) marked crosswalks alone should not be used at unsignalized locations.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient, since pedestrian crash risk may be increased due to providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

*** The raised median or crossing island must be at least 4 ft (1.2 m) wide and 6 ft (1.8 m) long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and American Association of State Highway and Transportation Officials (AASHTO) guidelines.

Source: [Zegeer, et. al., FHWA, 2002.](#)



Peer Agency Review

The development of Clark County’s **enhanced pedestrian crossing treatment decision tool** relies on information gathered from peer agencies with adopted pedestrian crossing decision making processes. PBOT, the City of Boulder, and VDOT each follow unique decision making steps when considering an enhanced pedestrian crossing at specific locations. Each agency’s process is summarized below.

City of Portland, OR Bureau of Transportation (PBOT)

PBOT developed a simple and effective tool to assess the need for various types of pedestrian crossing facilities at certain locations on city-owned streets. PBOT’s tool includes a decision tree to assist in justifying the need for a pedestrian crossing facility, and if warranted, the type of facility that should be installed at locations under consideration. PBOT adopted a crosswalk assessment tool to tailor crosswalk treatments at specific locations, using the following two-step process:

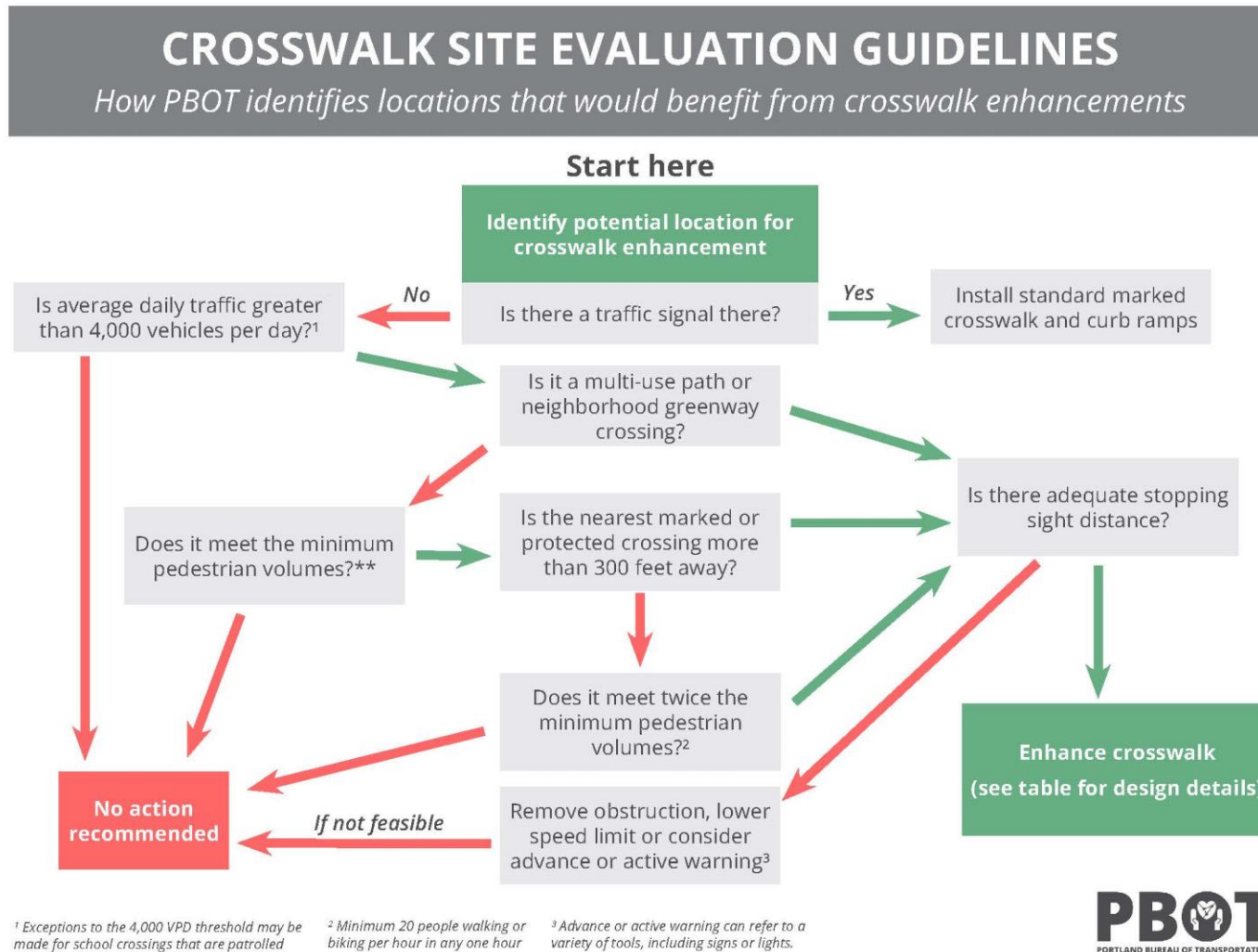
1. A flow chart that determines the need for enhanced crosswalk treatments at specific locations (See Figure 6 below).
2. If the flow chart determines that a location warrants an enhanced crosswalk, an evaluation table that provides guidance in determining the recommended crossing treatment type depending on the number of roadway lanes, Average Daily Traffic (ADT), and speed at the location under consideration (See Figure 7 below). The table includes four unique enhanced crossing facilities types for consideration. PBOT provides public data on traffic counts, speeds, and roadway types for use in considering the need and type of pedestrian crossing facility.

PBOT’s decision tool includes several unique factors that were considered when developing Clark County’s decision tool, as described in Table 2.

Table 2. PBOT’s Pedestrian Crossing Treatment Tool Features

The flow chart (Figure 6):
<ul style="list-style-type: none"> Does not consider specific guidance on a location with an existing stop sign
<ul style="list-style-type: none"> Does not consider specific guidance on school crossing locations
<ul style="list-style-type: none"> Eliminates any location that crosses a roadway with under 4,000 ADT, limiting the possibility of installing any type of crosswalk on lower volume facilities
<ul style="list-style-type: none"> Considers a minimum pedestrian volume trigger of 20 pedestrians or cyclists per hour
<ul style="list-style-type: none"> Considers crossing treatment at a location within 300 feet of an existing marked or protected crossing if it meets twice the minimum pedestrian volumes
<ul style="list-style-type: none"> Does not consider distance to nearest marked or protected crossing if an unsignalized multi-use path or neighborhood greenway warrants a crossing, which may result in closely spaced crossing locations
The evaluation table (Figure 7):
<ul style="list-style-type: none"> Categorizes facility selection for 2-lane, 3-lane (with and without raised median), and multi-lane (4+, with and without raised median) roadway facilities
<ul style="list-style-type: none"> Categorizes facility selection into three speed groups: 30 mph or under, 35 mph, and 40 mph and over, limiting the need for guidance on higher speed (45+) roadway facilities
<ul style="list-style-type: none"> Includes four enhanced crossing treatment categories, including a specific facility category that includes a marked crosswalk, island or curb extension, and enhanced signing and striping

Figure 6. PBOT Crosswalk Guideline Flow Chart



Source: [Portland Bureau of Transportation](#)

Figure 7. PBOT Crosswalk Options Table

CROSSWALK DESIGN BY ROADWAY TYPE*												
	VEHICLE ADT > 4,000 - 9,000			VEHICLE ADT > 9,000 - 12,000			VEHICLE ADT > 12,000 - 15,000			VEHICLE ADT > 15,000		
	<30 MPH	35 MPH	40+ MPH	<30 MPH	35 MPH	40+ MPH	<30 MPH	35 MPH	40+ MPH	<30 MPH	35 MPH	40+ MPH
TWO LANES	●	●	●	●	●	●	●	●	●	●	●	●
THREE LANES WITH RAISED MEDIAN	●	●	●	●	●	●	●	●	●	●	●	●
THREE LANES WITHOUT RAISED MEDIAN	●	●	●	●	●	●	●	●	●	●	●	●
MULTILANE WITH RAISED MEDIAN	●	●	●	●	●	●	●	●	●	●	●	●
MULTILANE WITHOUT RAISED MEDIAN	●	●	●	●	●	●	●	●	●	●	●	●

* All crossings must be scoped by an engineer to ensure recommended treatment is appropriate and ADA ramps and illumination are in place.

- Marked Crosswalk
- Marked Crosswalk, island or curb extensions, enhanced signing and striping
- Marked Crosswalk and enhanced/active warning (islands and RRFB's)
- Marked Crosswalk and pedestrian hybrid or full signal



Source: [Portland Bureau of Transportation](#)

City of Boulder, Colorado

The City of Boulder established a long-term goal of providing safe and efficient pedestrian facilities to reduce the dependency on the personal automobile. Boulder originally developed pedestrian crossing treatment warrants in 1996, but has since refined the decision process to guide the implementation of enhanced crossing facilities. The City uses the following 4-step evaluation process in coordination with an evaluation worksheet when considering and evaluating enhanced pedestrian crossing improvements:

1. **Identification and description of crossing locations**, including connections to a multi-use path, speed limits, and existing traffic control.
2. **Physical data collection**, including roadway configuration (number of lanes, presence of a painted/raised median), distance to nearest marked or protected crossing, and stopping sight distance for all approaches.
3. **Traffic data collection and operational observations**, including pedestrian crossing volumes during peak hours of use (and in some cases up to three consecutive days to determine pedestrian volume fluctuation), vehicle ADT along the major roadway at the crossing location, and vehicle queues from adjacent intersections.
4. **Applying data to the:**
 - *Pedestrian Crossing Treatment Flowchart* (Figure 8)
 - *Criteria for Crossing Treatment at Uncontrolled Locations* (Figure 9)
 - *City of Boulder Guidelines for the Installation of HAWK Beacons, Pedestrian Signals, or RRFB Signs on Low- and High-Speed Roadways* (Figure 10), which tailors the pedestrian signal warrant methodology developed in NCHRP 562 to City of Boulder conditions

Boulder's guidelines also include several supplemental policies to guide the installation of crossing treatments in the City, including crosswalk lighting, avoiding overuse of crossing treatments, multi-use path crossings, textured and colored pavement treatments, accessible crosswalks, raised crossings at right-turn bypass islands, and removal of treatments.

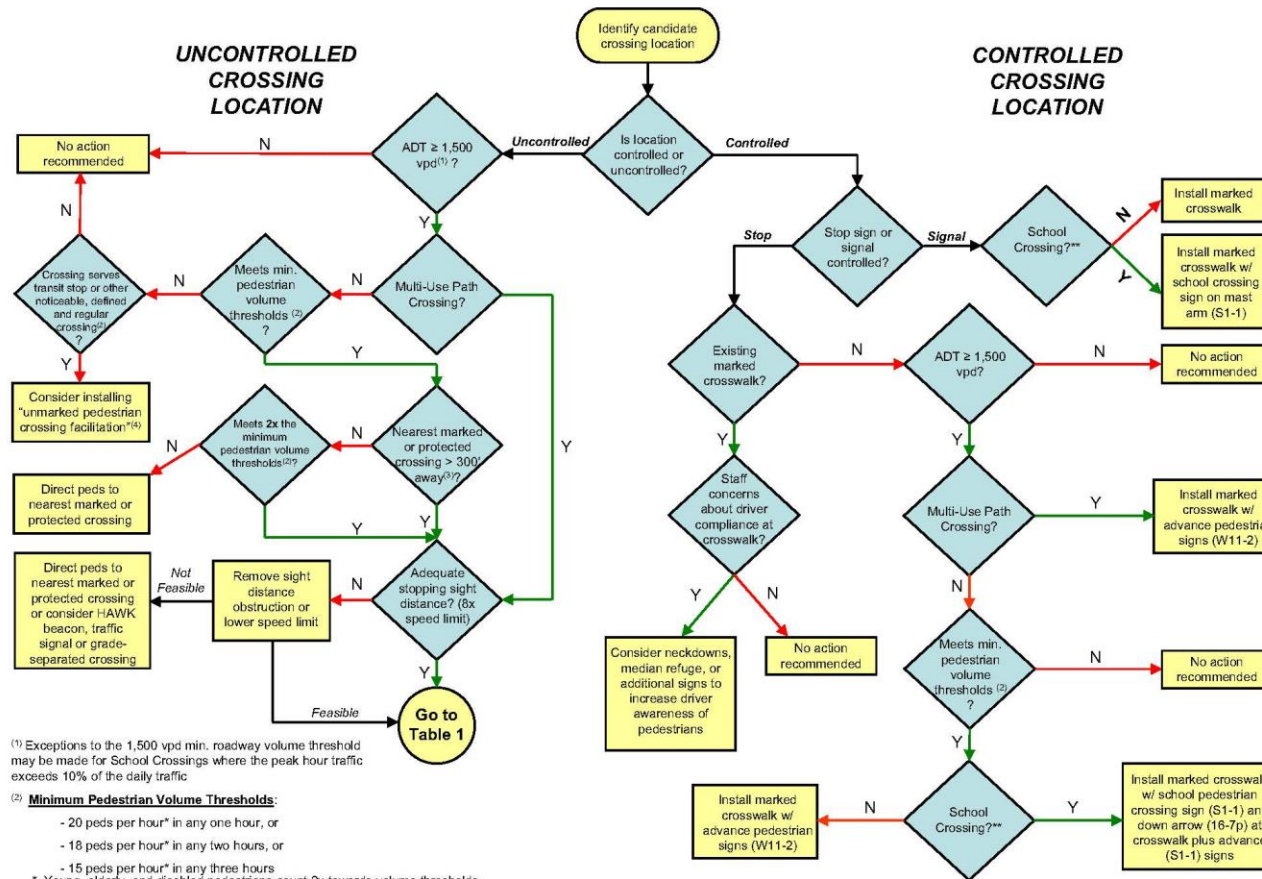
Boulder's decision tool includes several unique factors that were considered when developing Clark County's decision tool, as described in Table 3.



Table 3. Boulder’s Pedestrian Crossing Treatment Tool Features

The flow chart (Figure 8):
<ul style="list-style-type: none"> • Considers specific guidance on locations that are uncontrolled and controlled, including stop signs
<ul style="list-style-type: none"> • Considers specific guidance on school crossing locations
<ul style="list-style-type: none"> • Eliminates any location that crosses a roadway with under 1,500 ADT, increasing the possibility of installing a crosswalk on lower volume facilities
<ul style="list-style-type: none"> • Considers a variety of minimum pedestrian volume triggers depending on the time period (20 pedestrians per hour for any one hour; 18 pedestrians per hour for any two hours, 15 pedestrians per hour for any three hours)
<ul style="list-style-type: none"> • Counts young, elderly, and disabled pedestrians as double toward volume thresholds
<ul style="list-style-type: none"> • Considers crossing treatment at a location within 300 feet of an existing marked or protected crossing if it meets twice the minimum pedestrian volumes
<ul style="list-style-type: none"> • Considers crossing treatment for locations that do not meet minimum pedestrian volume triggers but serves a transit stop
<ul style="list-style-type: none"> • Does not consider distance to nearest marked or protected crossing if an uncontrolled multi-use path warrants a crossing, which may result in closely spaced crossing locations
The criteria table (Figure 9):
<ul style="list-style-type: none"> • Categorizes facility selection for 2-lane (one-way or two-way), 3-lane (with raised or striped median), 4-lane (without median), 5-lane (with raised or striped median), and 6-lane (with or without median) roadway facilities
<ul style="list-style-type: none"> • Categorizes facility selection into three speed groups: 30 mph or under 35 mph, 40 mph, and 45 mph or greater, improving guidance on higher speed (45+) roadway facilities
<ul style="list-style-type: none"> • Includes six enhanced crossing treatment categories, each with specific guidance pertaining to signing and striping suggestions
<ul style="list-style-type: none"> • Includes suggestions on determining the possibility of reducing speed limits to trigger different treatment options
<ul style="list-style-type: none"> • Suggests conducting additional evaluation for signalized crossing treatments for low- and high-speed roadways using Figure 10 below

Figure 8. Boulder’s Pedestrian Crossing Treatment Flowchart



(1) Exceptions to the 1,500 vpd min. roadway volume threshold may be made for School Crossings where the peak hour traffic exceeds 10% of the daily traffic

(2) **Minimum Pedestrian Volume Thresholds:**

- 20 peds per hour* in any one hour, or
- 18 peds per hour* in any two hours, or
- 15 peds per hour* in any three hours

* Young, elderly, and disabled pedestrians count 2x towards volume thresholds

** School Crossing defined as a crossing location where ten or more student pedestrians per hour are crossing.

(3) Distance to nearest marked or protected crossing may be reduced to 200' in urban conditions, subject to engineering judgment, where 1) the crosswalk does cross any auxiliary lanes, and 2) crossing treatments and crossing activity would not create undue restriction to vehicular traffic operations.

(4) An "unmarked pedestrian crossing facilitation" is any treatment that improves a pedestrian's ability to cross a roadway, short of the marked, signed and enhanced crossings detailed in Table 1. Installation of this type of pedestrian facilitation is subject to engineering judgment and may include curb ramps and/or a raised median refuge. However, no effort is made to attract pedestrians or recommend that pedestrians cross at this location. The treatments simply provide an improvement for a low volume pedestrian crossing where pedestrians are already crossing and will like continue to cross.

Source: [City of Boulder, CO, 2011.](#)



Figure 9. Boulder’s Criteria for Crossing Treatment at Uncontrolled Locations

Roadway Configuration	# of lanes crossed to reach a refuge ⁽¹⁾	# of multiple threat lanes ⁽²⁾ per crossing	Roadway ADT and Posted Speed															
			1,500-9,000 vpd				9,000-12,000 vpd				12,000-15,000 vpd				> 15,000 vpd			
			≤ 30 mph	35 mph	40 mph	≥ 45 mph	≤ 30 mph	35 mph	40 mph	≥ 45 mph	≤ 30 mph	35 mph	40 mph	≥ 45 mph	≤ 30 mph	35 mph	40 mph	≥ 45 mph
2 Lanes (one way street)	2	1	A	B	C	E	A	B	C	E	B	B	C	E	B	C	C	E
2 Lanes (two way street with no median)	2	0	A	B	C	E	A	B	C	E	B	B	C	E	B	C	C	E
3 Lanes w/Raised Median	1 or 2	0 or 1	A	B	D	E	A	C	D	E	B	D	D	E	C	D	D	E
3 Lanes w/Striped Median	3	0 or 1	C	C	D	E	C	C	D	E	C	C	D	E	C	D	D	E
4 Lanes (two way street with no median)	4	2	A	D	D	E	B	D	D	E	B	D	D	E	D	D	D	E
5 Lanes w/Raised Median	2 or 3	2	A	B	D	E	B	C	D	E	B	C	D	E	C	C	D	E
5 Lanes w/Striped Median	5	2	D	D	D	E	D	D	D	E	D	D	D	E	D	D	D	E
6 Lanes (two way street with or without median)	3 to 6	4	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

Notes:

- Painted medians can never be considered a refuge for a crossing pedestrian. Similarly, a 4 foot wide raised median next to a left turn lane can only be considered a refuge for pedestrians if the left turning volume is less than 20 vehicles per hour (meaning that in most cases the left turn lane is not occupied while the pedestrian is crossing).
- A multiple threat lane is defined as a through lane where it is possible for a pedestrian to step out from in front of a stopped vehicle in the adjacent travel lane (either through or turn lane).

Treatment Descriptions:

A **Install marked crosswalk with enhanced road-side signs**
Specific Guidance: Install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway with standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations.

B **Install marked crosswalk with enhanced road-side and in-roadway (bollard mounted) signs**
Specific Guidance: Install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway and on in-roadway bollards; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations.

C **Install marked crosswalk with enhanced signs and geometric improvements to increase pedestrian visibility and reduce exposure**
Specific Guidance: For 2 or 3-lane roadways, install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway and on in-roadway bollards or median mounted signs; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations. Add neckdowns or median refuge islands to shorten the pedestrian crossing distance and increase pedestrian visibility to motorists.

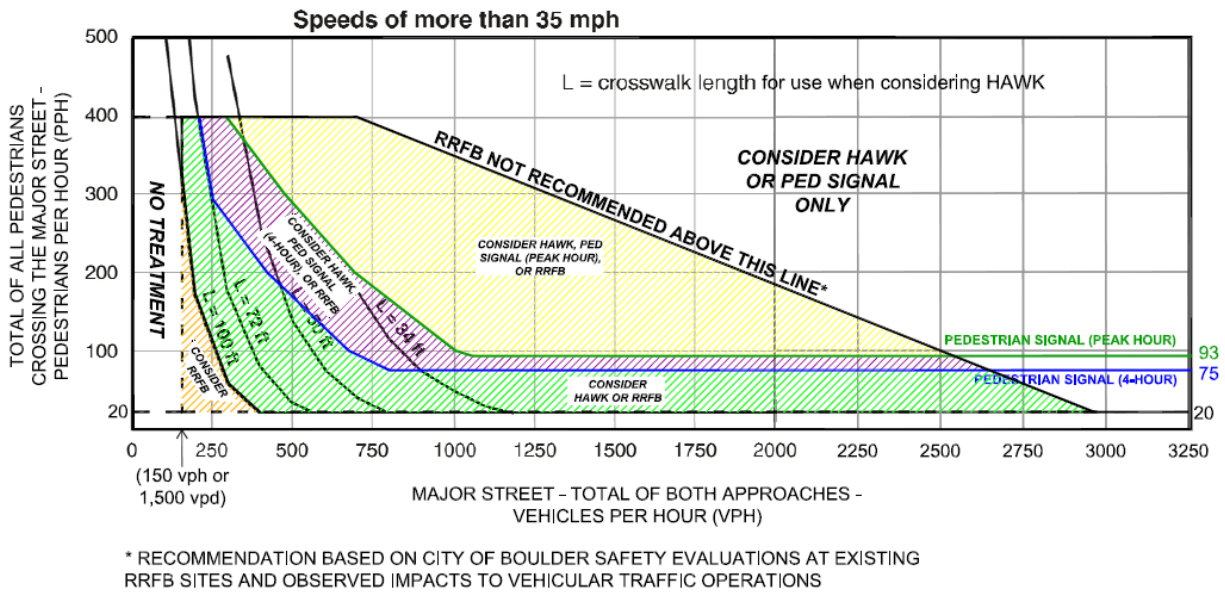
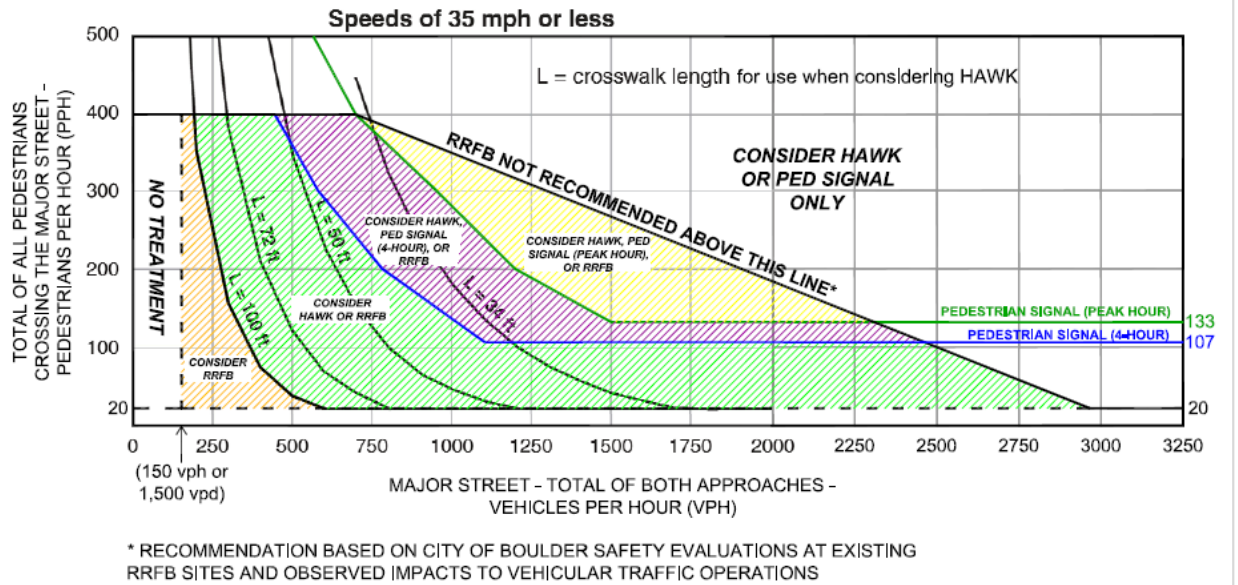
D **Install marked crosswalk with enhanced signs, pedestrian activated RRFBs, and geometric improvements to increase pedestrian visibility and reduce exposure**
Specific Guidance: Install raised median refuge island (unless it is a one-way street or one already exists) to shorten the pedestrian crossing distance and increase pedestrian visibility to motorists. [If a median refuge can not be constructed on a two-way street, Go To Scenario F]. Install marked crosswalk with "State Law - Yield to Pedestrian" signs WITH pedestrian activated RRFBs mounted on the side of the roadway and on median mounted signs; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations. Consider adding neckdowns at the crossing if on-street parking exists on the roadway and storm drain considerations will allow. [Note: If pedestrian volume falls above the RRFB limit line on Figure 2, consider Hawk beacon, pedestrian traffic signal, or grade-separated crossing.]

E **Do not install marked crosswalk at uncontrolled crossing. Determine if the speed limit can be effectively reduced to 40 mph AND a raised refuge median can be installed. If so, utilize Scenario D criteria above. If this is not possible, or if pedestrian volume falls above the RRFB limit line on Figure 2, consider HAWK beacon, pedestrian traffic signal, or grade-separated crossing.**
Specific Guidance: Consider HAWK beacon, pedestrian traffic signal or grade-separated crossing; application of these treatments will consider corridor signal progression, existing grades, physical constraints, and other engineering factors

F **Do not install marked crosswalk at uncontrolled crossing with 3 or more THROUGH lanes per direction or where the speed limit is ≥ 45 mph and/or there is not a median refuge on a 5-lane crossing. Consider HAWK beacon, pedestrian traffic signal, or grade-separated crossing.**
Specific Guidance: Consider HAWK beacon, pedestrian traffic signal or grade-separated crossing; application of these treatments will consider corridor signal progression, existing grades, physical constraints, and other engineering factors

Source: [City of Boulder, CO, 2011.](#)

Figure 10. City of Boulder Guidelines for the Installation of HAWK Beacons, Pedestrian Signals, or RRFB Signs on Low- and High-Speed Roadways



Source: [City of Boulder, CO, 2011](#).



Virginia Department of Transportation (DOT)

The Virginia Transportation Research Council (a cooperative organization sponsored by the Virginia DOT and the University of Virginia) developed a marked crosswalk justification process to determine the need for special treatment at uncontrolled crossing locations, which includes the following two-step process:

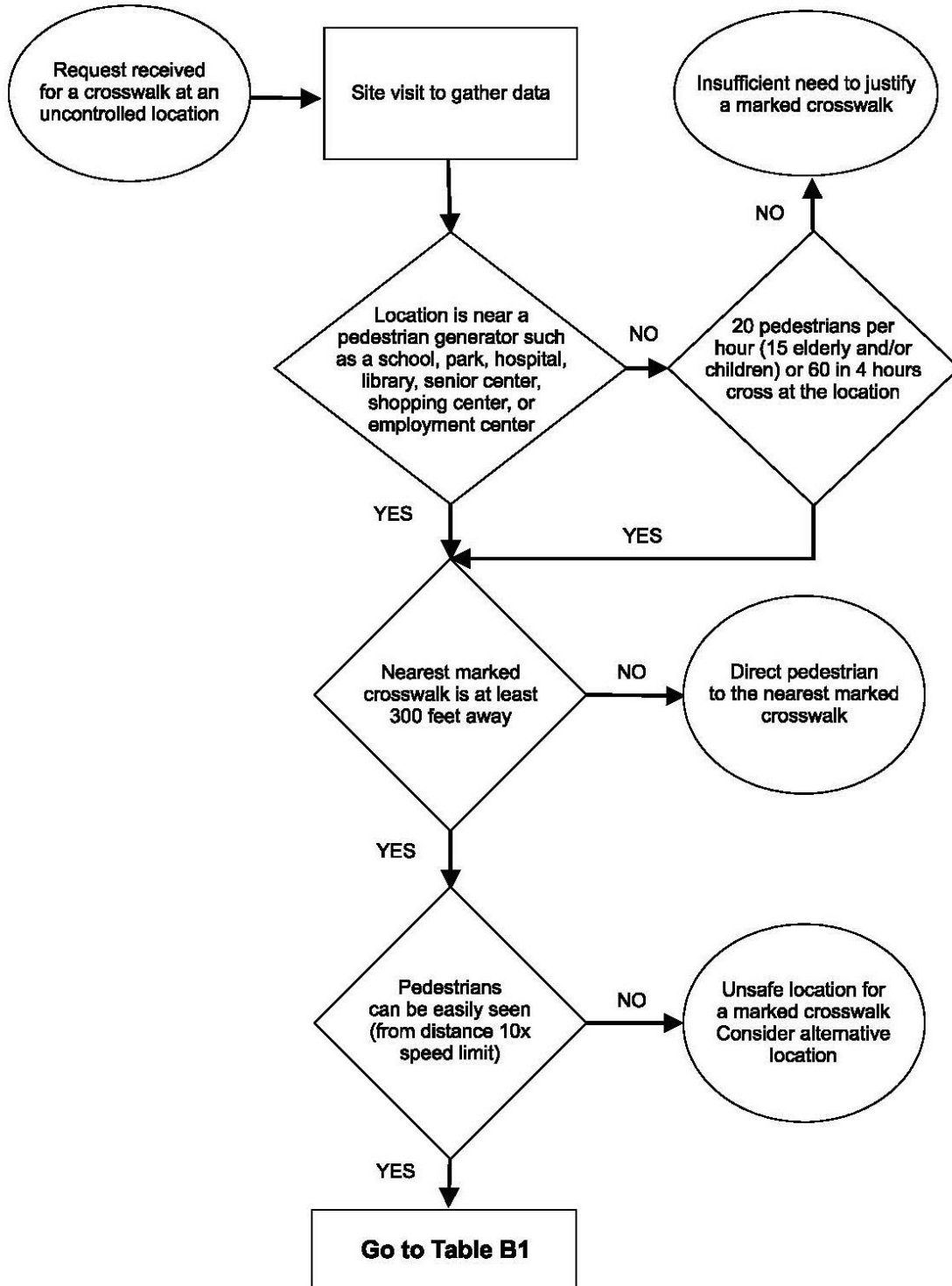
- Sufficient demand for crosswalk installation must exist at uncontrolled crossings, and need must be determined using a flow chart that evaluates the justification for a marked crosswalk at specific locations (See Figure 11 below).
- If the flow chart determines that a location warrants an enhanced crosswalk, an evaluation table provides guidance in determining the recommended crossing treatment type depending on the number of roadway lanes, vehicle ADT, and speed at the location under consideration (See Figure 12 below). The table includes guidance on the recommended action, including specific guidance on a variety of different devices:
 - **Level 1:** Standard crosswalks, raised mid-block crosswalks, and rumble strips
 - **Level 2:** High-visibility crosswalks
 - **Level 3:** Refuge islands, split pedestrian crossovers, bulb-outs (curb extensions)
 - **Level 4:** Overhead signs and flashing beacons, in-roadway warning lights
 - **Level 5:** Pedestrian-actuated signals, grade separated crossings

VDOT’s decision tool includes several unique factors that were considered when developing Clark County’s decision tool, as described in Table 4.

Table 4. VDOT’s Pedestrian Crossing Treatment Tool Features

The flow chart (Figure 11):
<ul style="list-style-type: none"> • Only considers specific guidance at uncontrolled locations
<ul style="list-style-type: none"> • Includes general guidance on pedestrian generators (including schools)
<ul style="list-style-type: none"> • Does not have any minimum ADT threshold, allowing all crossing locations to be considered regardless of roadway volumes
<ul style="list-style-type: none"> • Considers a variety of minimum pedestrian volume triggers depending on the time period and pedestrian type (20 pedestrians per hour for any one hour, 15 elderly and/or children per hour for any one hour, 60 pedestrians in four hours)
<ul style="list-style-type: none"> • Does not include any guidance for multi-use paths
The evaluation table (Figure 12):
<ul style="list-style-type: none"> • Categorizes facility selection for 2-lane, 3-lane, and multi-lane (4+, with and without raised median) roadway facilities
<ul style="list-style-type: none"> • Categorizes facility selection into three speed groups: 30 mph or under, 35 mph, and 40 mph and over, limiting the need for guidance on higher speed (45+) roadway facilities
<ul style="list-style-type: none"> • Includes three types of recommended actions, rather than specific treatment type, although suggests considerations of various improvement types

Figure 11. VDOT Flowchart for Justifying Installation of Marked Crosswalks at Uncontrolled Locations



Source: Virginia Transportation Research Council, 2004.

Figure 12. VDOT Enhanced Pedestrian Crossing Selection Evaluation Table

Table B1. Recommendations for Considering Marked Crosswalks and Other Needed Pedestrian Improvements at Uncontrolled Locations^a

	≤ 9,000 ADT			> 9,000 ADT to ≤ 12,000 ADT			> 12,000 ADT to ≤ 15,000 ADT			> 15,000 ADT		
	≤30 mph	36 mph	≥40 mph	≤30 mph	36 mph	≥40 mph	≤30 mph	36 mph	≥40 mph	≤30 mph	36 mph	≥40 mph ^b
2 lanes												
3 lanes												
++4 lanes, raised median ^c												
++4 lanes, no median												

- Candidate sites for marked crosswalks.** Marked crosswalks must be installed carefully and selectively. First, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, but a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc., may be needed at other sites. If the speed limit is less than or equal to 30 mph, use Level 1 or Level 2 devices. If the speed limit exceeds 30 mph, use Level 2 devices. *Refer to Level 1 and Level 2 devices in the Special Treatments section.*
- Probable candidate sites for marked crosswalks.** Pedestrian crash risk may increase if marked crosswalks are added without other pedestrian facility enhancements. Add Level 3 or Level 4 devices if feasible. *Refer to Level 3 and Level 4 devices in the Special Treatments section.*
- Marked crosswalks alone are insufficient, since pedestrian crash risk may increase if only marked crosswalks are provided.** Consider using Level 5 devices if feasible. If not feasible, use multiple treatments from Level 2, Level 3, or Level 4 devices. *Refer to Level 5 devices in the Special Treatments section.*

^aThese guidelines include intersection and mid-block locations with no traffic signal or stop sign on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor site distance, complex or confusing designs, substantial volumes of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make a crossing safer or necessarily result in more drivers stopping for pedestrians. Whenever marked crosswalks are installed, it is important to consider other pedestrian facility enhancements, as needed, to improve the safety of the crossing (for example, raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic calming measures, curb extensions). **These are general recommendations; an engineering study should be performed to determine where to install marked crosswalks.**

^bWhere the posted speed limit or 85th percentile speed exceeds 40 mph, marked crosswalks alone should not be used at uncontrolled intersections with an ADT greater than 15,000.

^cThe raised median or refuge island must be at least 4 feet (1.2 meters) wide and 6 feet (1.8 meters) long to adequately serve as a refuge area for pedestrians.

Source: Virginia Transportation Research Council, 2004.

Clark County's Enhanced Pedestrian Crossing Treatment Decision Tool

Utilizing research gathered from national best practices and peer agencies described above, the draft Clark County enhanced pedestrian crossing treatment decision tool provides guidance on when a marked crosswalk or other treatments would be appropriate using a set of criteria and triggers. The tool follows a two-step process, similar to the peer agencies reviewed above:

- Figure 13 illustrates the draft Clark County **pedestrian crossing treatment decision flow chart**, which identifies when an enhanced crosswalk at an existing unmarked location would be appropriate using a series of criteria.
- Figure 14 details the draft Clark County **enhanced crossing treatment selection table**, providing various treatment options if enhanced pedestrian treatments are justified at a location under consideration. Figure 14 is largely based on the original “Zegeer Table” structure and treatment selection.

Both the flow chart and treatment selection table were influenced by county facility data provided by Clark County staff, including the following:

- Approximately 82% of all Clark County collector and arterials roads are 3 lanes or fewer, with 2-lane roads representing more than 79% of all County collector and arterials roads
- In Clark County, the average ADT is 12,000 for urban arterials and is 2,400 for urban collectors
- In Clark County, the average ADT is 5,000 for rural arterials and is 1,600 for rural collectors

Clark County's decision tool includes several unique factors that incorporate a combination of components from peer agencies and other factors, as described in Table 5.



Table 5. Clark County’s Pedestrian Crossing Treatment Tool Features

The flow chart (Figure 13):	
•	Considers specific guidance on locations that are uncontrolled and controlled (for both signals and stop signs)
•	Considers specific guidance on school crossing locations, and refers to the existing Clark County School Zone Traffic Control Policy when appropriate
•	Eliminates any location that crosses a roadway with under 2,500 ADT , increasing the possibility of installing a crosswalk on lower volume facilities
•	Considers a variety of minimum pedestrian volume triggers depending on the time period (20 pedestrians per hour for any one hour; 18 pedestrians per hour for any two hours, 15 pedestrians per hour for any three hours)
•	Considers 300 feet as minimum separation distance to nearest marked or protected crossing if an uncontrolled multi-use path warrants a crossing, which limits the occurrence of closely spaced crossing locations
The treatment selection table (Figure 14):	
•	Categorizes facility selection for 2-lane, 3-lane, and multi-lane (4+, with and without raised median) roadway facilities.
•	Categorizes facility selection into three speed groups: 30 mph or under, 35 mph, and 40 mph and over
•	Includes five types of recommended actions, including marked crosswalks, enhanced pedestrian crossing treatments (e.g., islands and RRFBs), and regulatory traffic controls including hybrid beacon and signalized crossings



Figure 13. Clark County Pedestrian Crossing Treatment Decision Flow Chart

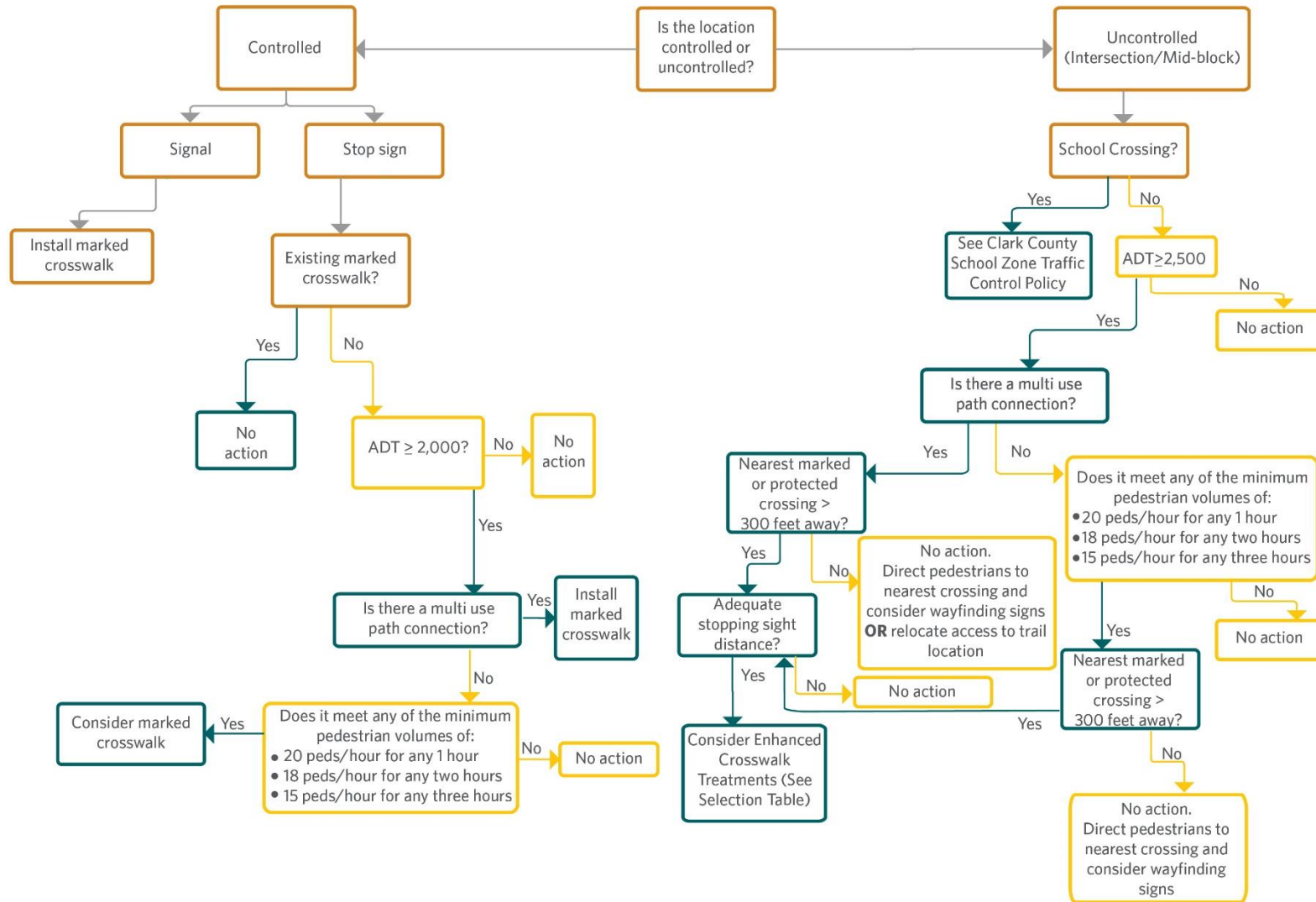




Figure 14. Clark County Enhanced Crossing Treatment Selection Table

ROADWAY TYPE (NUMBER OF TRAVEL LANES)	VEHICLE ADT > 2,500 TO 4,000			VEHICLE ADT > 4,000 TO 9,000			VEHICLE ADT > 9,000 TO 12,000			VEHICLE ADT > 12,000 TO 15,000			VEHICLE ADT >15,000		
	SPEED LIMIT*														
	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH	≤ 30 MPH	35 MPH	≥ 40 MPH
2 Lanes	A	A	B	B	B	B	B	B	B	B	D/E	E	B	D/E	E
3 Lanes	A	A	B	C	C	D	C	D	D	D	D	E	D	D	E
Multi-Lane (4 or more Lanes)	C	C	C	C	C	D	C	D	E	D	D	E	E	E	E

- A** Marked Crosswalk
- B** Marked Crosswalk with RRFB
- C** Marked Crosswalk with Island
- D** Marked Crosswalk with enhancement / active warning (islands and RRFB's)
- E** Marked Crosswalk and pedestrian hybrid or full signal

* Where the speed limit exceeds 40 mph marked crosswalks alone should not be used at unsignalized locations.

Source: Zegeer, Steward, Huang, "Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines", FHWA, 2002.

Appendix B: Crossing Evaluation Worksheets



UNCONTROLLED CROSSING EVALUATION WORKSHEET

LOCATION DESCRIPTION

Major Street: _____ Crossing or Minor Street Location: _____

Is this a shared-use path crossing? Yes No

Existing Crossing Treatments (if any): _____

Nearby Pedestrian Generators (School, transit stop, commercial, etc.): _____

PHYSICAL DATA

Major Roadway Configuration:

<input type="checkbox"/> 2-Lane	<input type="checkbox"/> 5 Lane w/Striped Median
<input type="checkbox"/> 3-Lane w/Striped Median	<input type="checkbox"/> 5 Lane w/Raised Median
<input type="checkbox"/> 3 Lane w/Raised Median	<input type="checkbox"/> 6 Lane
<input type="checkbox"/> 4 Lane	<input type="checkbox"/> Other: _____

Crossing Distance By Direction: _____ ft total _____ ft to median island with pedestrian refuge

Marked or Protected Pedestrian Crossing Nearby? Yes No

Distance from location: _____ ft

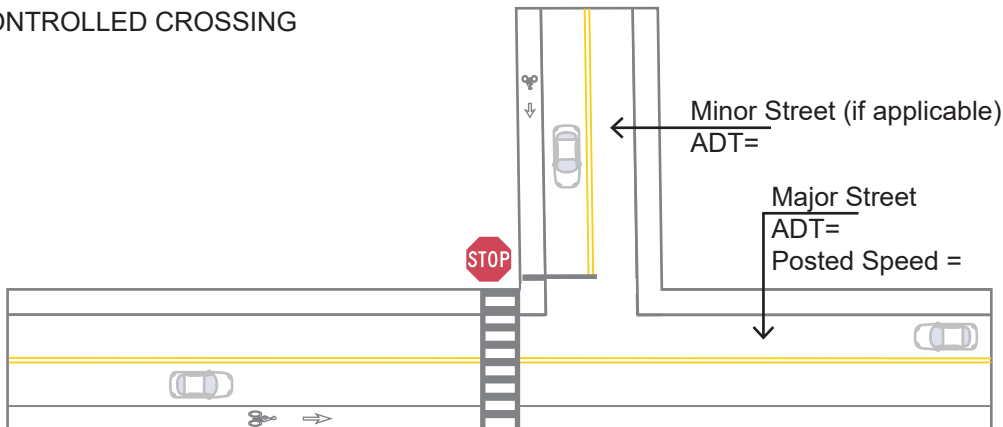
Stopping Sight Distance (SSD) = _____ ft

PEDESTRIAN/TRAFFIC DATA

Pedestrian Crossing Volumes:

	1 hr	2 hr	3 hr	Other
Time:	to	to	to	to
Date/Day of Week:	/	/	/	/
Total Pedestrians:				
Total Pedestrians /hr:	/	/	/	/

UNCONTROLLED CROSSING





CONTROLLED CROSSING EVALUATION WORKSHEET

LOCATION DESCRIPTION

Major Street: _____ Minor Street: _____

Is this a shared-use path crossing? Yes No

Existing Traffic Control: Stop Sign Traffic Signal Roundabout Other: _____

Existing Crossing Treatments (if any): _____

Nearby Pedestrian Generators (School, transit stop, commercial, etc.): _____

PHYSICAL DATA

- Minor Roadway Configuration: 2-Lane
 3-Lane w/Striped Median
 3 Lane w/Raised Median

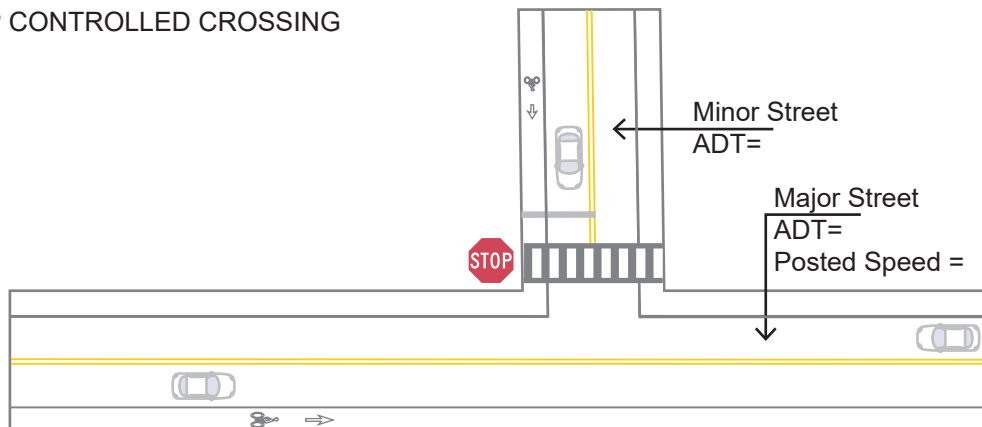
Crossing Distance By Direction: _____ ft total _____ ft to median island with pedestrian refuge

PEDESTRIAN/TRAFFIC DATA

Pedestrian Crossing Volumes:

	1 hr	2 hr	3 hr	Other
Time:	to	to	to	to
Date/Day of Week:	/	/	/	/
Total Pedestrians:				
Total Pedestrians /hr:	/	/	/	/

STOP CONTROLLED CROSSING





SCHOOL CROSSWALK EVALUATION WORKSHEET

LOCATION DESCRIPTION

Major Street: _____ Crossing or Minor Street Location: _____

Is the crossing located adjacent to a school and/or shown in School Route Plan? Yes No

Existing Crossing Treatments (if any): _____

School Level: Preschool Elementary Middle High College Other

PHYSICAL DATA

Major Roadway Configuration:

<input type="checkbox"/> 2-Lane	<input type="checkbox"/> 5 Lane w/Striped Median
<input type="checkbox"/> 3-Lane w/Striped Median	<input type="checkbox"/> 5 Lane w/Raised Median
<input type="checkbox"/> 3 Lane w/Raised Median	<input type="checkbox"/> 6 Lane
<input type="checkbox"/> 4 Lane	<input type="checkbox"/> Other: _____

Crossing Distance By Direction: _____ ft total _____ ft to median island with pedestrian refuge

Marked or Protected Pedestrian Crossing Nearby? Yes No

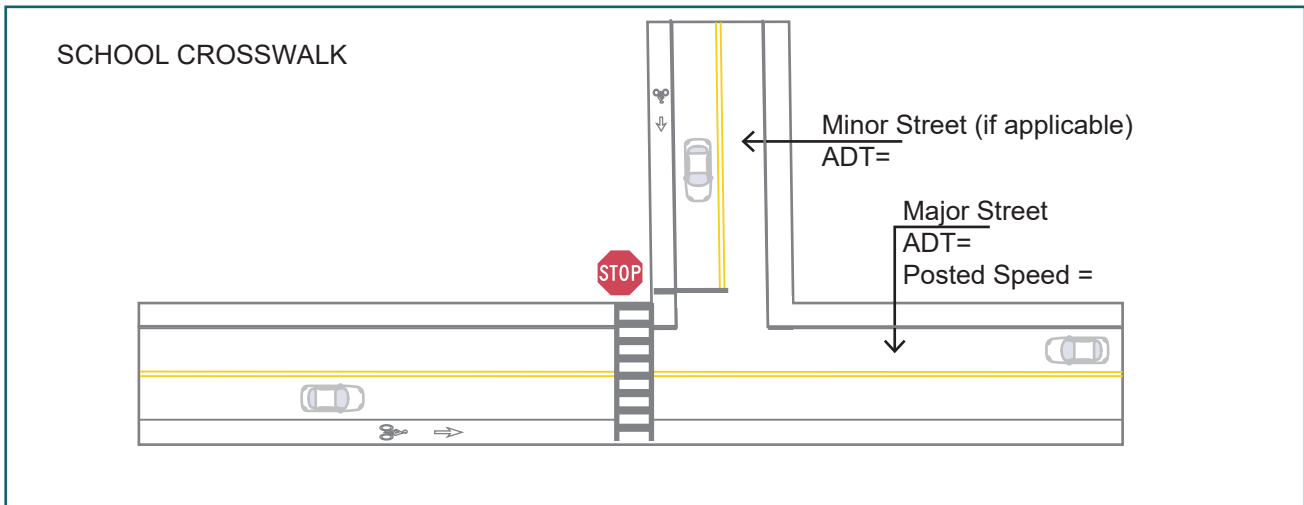
Distance from location: _____ ft

Stopping Sight Distance (SSD) = _____ ft

PEDESTRIAN/TRAFFIC DATA

Children Crossing Volumes:

	1 hr
Time:	to
Date/Day of Week:	/
Total Children:	
Total Children/hr:	/



Appendix C: HCM Pedestrian Delay Analysis Results



Appendix C – HCM Pedestrian Crossing Delay

This appendix describes the Synchro analysis that was used to calculate pedestrian delay for pedestrian crossings across an uncontrolled approach of a two-way stop controlled intersection or at a mid-block location. The Synchro analysis was used to validate the development of the Enhanced Crossing Treatment Selection Table to assess how much delay a crossing pedestrian would experience when using various treatments, including: marked crosswalk, flashing beacon, or a median island with pedestrian refuge.

The Highway Capacity Manual (HCM) 6th Edition analysis calculates pedestrian delay for pedestrian crossings across an uncontrolled approach of a two-way stop controlled intersection or at a mid-block location. The methodology correlates pedestrian delay in seconds per pedestrian to specified level of service standards, as displayed in Table 1.

Table 1. HCM Exhibit 20-3 LOS Criteria: Pedestrian Mode

LOS	Control Delay (s/p)	Comments
A	0-5	Usually no conflicting traffic
B	5-10	Occasionally some delay due to conflicting traffic
C	10-20	Delay noticeable to pedestrians, but not inconveniencing
D	20-30	Delay noticeable and irritating, increased likelihood of risk taking
E	30-45	Delay approaches tolerance level, risk-taking behavior likely
F	>45	Delay exceeds tolerance level, high likelihood of pedestrian risk taking

The County chose a threshold of between LOS B and C, or less than 15 seconds of delay where no treatment would be necessary due to the minor delay incurred by the pedestrian. Additionally, the County selected a threshold of LOS D, or less than 30 seconds of delay where only a marked crosswalk would be sufficient without an enhanced pedestrian crossing treatment. Table 2 details the results of the Synchro analysis for different roadway widths and volumes. Any delay of less than 15 seconds for crossing without a treatment, or less than 30 seconds for crossing with a treatment are highlighted to show treatments or lack of a treatment needed that meet the acceptable County thresholds for pedestrian delay.

The pedestrian delay analysis conducted in Synchro¹ assumed that the minimum pedestrian activity threshold was met, and covered the following parameters:

- Roadway cross sections – from two to five lane sections, with and without bike lanes or shoulders
- Pedestrian crossing distance – from 24 to 74 feet based on the cross section and standards assumed width for each roadway element
- Volume – from 300 to 1,600 vehicles/hour

¹ Trafficware Synchro 10



- Pedestrian crossing treatment – from no treatment (0% yield rate), to signs and markings (20% yield rate) and flashing beacons (81% yield rate) as well as a median island with pedestrian refuge

Table 2. Pedestrian Delay (seconds)

Volume (veh/hr)	Pedestrian Crossing Treatment	Number of Travel Lanes & Crossing Distance (feet)							
		2		3		4		5	
		24	36	38	50	48	60	62	74
300	None	5.4	11.0	12.2	21.4	19.6	32.2	34.7	53.6
	Marked Crosswalk	-	7.4	8.4	15.3	14.7	23.9	25.5	37.2
	Median Island	-	-	-	-	-	-	2.3	3.3
400	None	8.1	17.1	19.1	35.1	31.9	55.2	60.2	98.5
	Marked Crosswalk	-	12.3	13.9	26.4	22.8	36.7	38.7	51.6
	Median Island	-	-	-	-	-	4.7	3.3	4.7
600	None	15.2	35.6	40.6	83.7	74.6	146.1	162.7	305.3
	Marked Crosswalk	11.2	26.5	29.9	55.8	36.4	44.0	44.7	47.4
	Flashing Beacon	-	-	-	-	-	10.2	-	-
	Median Island	-	-	-	1.7	3.0	4.9	3.0	4.9
1,000	None	42.2	127.3	151.6	417.3	353.5	>500	>500	>500
	Marked Crosswalk	29.1	71.6	84.3	235.9	31.7	47.1	52.5	135.4
	Flashing Beacon	-	6.6	6.6	6.9	-	-	-	-
	Median Island	-	-	2.3	4.3	7.9	12.6	7.9	12.6
1,300	None	84.7	319.6	396.0	>500	138.3	>500	>500	>500
	Marked Crosswalk	48.2	180.7	226.5	>500	50.7	221.4	269.9	>500
	Flashing Beacon	5.0	5.3	5.4	5.6	-	-	-	-
	Median Island	3.5	6.6	3.5	6.6	13.1	20.8	13.1	20.8
	Flashing Beacon + Median Island	2.3	3.0	2.3	3.0	7.0	8.1	7.0	8.1
1,600	None	167.7	>500	>500	>500	>500	>500	>500	>500
	Marked Crosswalk	93.1	488.7	>500	>500	224.0	>500	>500	>500
	Flashing Beacon	4.3	4.5	4.5	4.8	-	-	-	-
	Median Island	5.0	8.8	5.0	8.8	19.3	30.5	19.3	30.5
	Flashing Beacon + Median Island	2.4	2.8	2.4	2.8	6.8	7.3	6.8	7.3

Notes:

- 1) Delay highlighted in green identifies delay of less than 30 seconds for crossings with a pedestrian treatment OR a delay of less than 15 seconds for crossings without a pedestrian treatment, these indicate that the delays meet the acceptable Clark County thresholds for pedestrian delay
- 2) Delay reported for median island pedestrian crossing treatment is for one stage of the crossing